The Monthly Review of the AMERICAN ELECTROPLATERS' SOCIETY

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AUGUST 1941

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THE MONTHLY REVIEW WILL HAVE ARTICLES BY WM. D. STARR

Mr. William D. Starr, Lea Manufacturing Company, Waterbury, Conn., will write a series of articles on "Supplies and Defense" for the MONTHLY REVIEW beginning with this issue.

Mr. Starr is keeping in close touch with such publications as *The Journal of Commerce, The Bulletin of the National Association of Purchasing Agents, Defense*—official weekly bulletin of the Office for Emergency Management, *Business Week*, Manufacturers Association of Connecticut bulletins, and others. Your comments, suggestions, and criticism will be welcome as the author of this page strives to keep the readers of the REVIEW informed on Defense Supplies during this critical period.

Supplies *and* Defense

by W. D. STARR
The Lea Mfg. Co.
Waterbury, Conn.

REPORTING on the availability of electroplating supplies sounds like a gloomy occupation, something like holding a wake for a number of departed friends. There are plenty of tough problems as most of us know, but at the same time there is more and more cooperation being given to firms having "legitimate" material requirements. "Legitimate" refers primarily to National Defense needs, though it also takes in certain important civilian requirements.

Familiar to everyone is the Priorities Division of OPM. Ratings it assigns to prime government contracts also apply to

subsequent sub-contracts which may involve plating. *After* receiving the order, supplies are procured from the usual sources if evidence of this priority is produced in proper form.

Unfamiliar to many is the Defense Supplies Rating Plan which enables firms doing Defense work to obtain scarce supplies *before* orders are received. Under this arrangement the OPM grants priority on the basis of percentage sales for Defense projects during the 1/4 year period previous to an application. A careful sales analysis must be made by the company requiring materials, and evidence obtained must be produced. Affidavits may be used where Preference Rating Certificates and other

W. D. STARR

formal evidence is difficult to obtain. OPM in Washington, also its district offices, are prepared to assist with the necessary forms and instructions.

For civilian needs, OPACS should be consulted. This alphabetical outfit, which sounds like part of a cablegram, is the Office of Price Administration and Civilian Supply. The C.S. part will interest us particularly as it is designed to obtain priority on non-defense orders which it considers essential for civilian purposes.

These agencies are working steadily to improve their service to industry and more specific details will be reported as pro-

cedures are perfected and clarified. It is important to regard OPM and OPACS as helpful organizations rather than to consider them as restraining or interfering with the flow of supplies. Their personnel is made up of industrial men who understand production problems and therefore can assist us intelligently.

Now for a brief look at the supply situation:

Zinc: Supply is said to have eased a little, though quantities for non-defense plating are currently reduced.

Copper: Under mandatory, industry-wide priority control as of May 29, 1941. Defense orders rated A-10 or better being filled ahead of civilian orders. Too early to predict extent of supply for plating.

Brass: As of July 9, 1941, same control as for Copper.

Chromic Acid: General Preference Order M-18 prohibits supply and procurement per month in excess of 1/12 the amount consumed from July 1, 1940 through June 30, 1941. However, indications are that this supply can be maintained for a substantial length of time.

Cadmium: Defense orders exceed total supply. High priorities are needed to obtain delivery.

Tin: At this writing, adequate supply for plating. Keep an eye on Japan.

Nickel: Supply is directed by formal allocation order directing flow toward defense uses. Supply for non-defense steadily diminishing.

Nickel Salts: Swell weather we've been having and we'll be with you again next month.

CHANGE OF COVER

Owing to the alu minum shortage, we have been obliged to make a change in our cover. We a re glad to do this in order to comply with the government's desire to conserve metals necessary for National Defense.

TO OUR ADVERTISERS AND BRANCH SECRETARIES

We are making a determined effort to have the MONTHLY REVIEW mailed much earlier in the month starting with the September issue. We earnestly desire the cooperation of our advertisers, advertising agencies and branch secretaries to this end by mailing your copy to us not later than the 20th of the month previous to publication, so that the REVIEW will be mailed not later than the tenth of each month.

1942 CONVENTION NEWS

The Grand Rapids Branch thanks the delegates to the Boston Convention for selecting Grand Rapids as their convention city in 1942.

Chester W. Smith has been selected as the General Chairman. "Chet" Smith familiar to many of you because of his activity, at both the Dayton and the Boston convention, in convincing delegates that they should come to

CHESTER W. SMITH

Chairman of the 1942 Convention Committee

Grand Rapids and learn firsthand why Grand Rapids enjoys the reputation of being "A Good Convention City." He is a good organizer, a hard worker, and we know that whatever he is behind, he will put across.

Without taking time to rest up from the Boston Convention, Chet immediately got busy and appointed the following committee chairmen to assist him in making the 1942 Grand Rapids Convention the best ever held anywhere.

Educational	Lyman B. Sperry	321 Carleton Ave., S. E.
Financial Secretary	Homer G. Morton	2615 Albert Dr. S. E.
Program-Publicity	F. D. Pace	134 Grandville S. W.
Advisory	Maurice R. Caldwell	1818 Union Blvd. S. E.
Registration	Charles O. Werft	1107 Powers N. W.
Housing	Clyde Craven	127 Wallinwood N. E.
Entertainment	Stewart Z. Martin	339 Palmer N. E.
Recreation	Jack J. Hanney	1109 Hoyt S. E.
Transportation	C. E. Abel	1150 Louis N. W.
Plant Visitation	Ivan C. Hepfer	1255 Orville S. E.
Exhibits	C. M. Fernekes	2020 College S. E.

These boys are working together with the same spirit of cooperation and teamwork that has made the Grand Rapids annual banquets so highly successful the last couple of years, so look forward to a most profitable and enjoyable convention when you come to Grand Rapids in 1942.

F. D. PACE, Program Publicity Chairman

Electroplating *and the* Chemical Engineer

WILLIAM C. GEISSMAN
Milwaukee Branch, A. E. S.

You have been reading a lot about the defense program. Some of you probably think you will need a defense program yourselves against those college lads who will be attacking the strongholds of our employment offices looking for jobs. I do think they will be looking to us for work, because college men studying chemical engineering today are well aware of the increasingly apparent fact that ours is one of the most rapidly developing and important of the newer industries rising to prominence in the American industrial scene. No doubt some of you would be surprised to know how much the plating industry has expanded. The Society itself, which is an index for the industry in a way, has increased its membership three-fold between the years 1921 and 1941. Society figures show that there were only 990 men enlisted with the organization in 1921. Today it boasts a membership almost three times that. We can assume that each member in this Society represents approximately fifteen persons occupied directly or indirectly in plating and its subsidiary industries. Roughly, that means forty-five thousand workers who are directly affected by changes in this industry.

Looking further into the size of our industry, I know that few of you will be surprised to know that in 1938 (the only recent year for which figures were available) there were over one million tons of steel plated with nickel alone, or over two billion pounds. And we all realize that far more zinc for example is used in the plating industry than nickel, so that, speaking for all metals used, it can very well be said that millions of tons of metal are passing through the hands of modern electroplaters each month. Nor would we have to go very far to illustrate the increasing importance of plating as a factor in the growth of major industries in the country. Decoration, a function served directly by the platers, has become of extreme importance in American life, since salability is naturally a direct outcome of attractive ap-

pearance in mechanical commodities. We can take for granted the fact that electroplating has far more importance and is far more necessary to industry and our American economy than ever before.

As I have already suggested, our colleges today are full of young men eager to find jobs in those industries where opportunity appears to be greatest. The chemical engineer, who is fast becoming the most important of all engineers, is especially observant of the growth of plating as an industry and much attention has suddenly come to be centered upon electroplating in college engineering schools. These boys realize that the electrodeposition of metals offers them a very real and challenging opportunity and they will soon be coming to officials in the industry to ask for work and a chance to make their contribution. I want to tell you something about these fellows; who they are and what I think their role will be in the expansion of this rising industry; for I am convinced that more and more the chemical engineer is going to help and be working with the foreman plater and his associates.

Who is the chemical engineer? The engineer, by definition, is a person who applies the principles of a science to industry, and in the case of the chemical engineer, he would be a person who applies the principles of the science of chemistry to industry wherever it depends upon chemical activity. I wish to make it clear at the outset that he is not a chemist as such. The chemist deals with the analysis of materials and the making of them in the laboratory and the study of the principles by which these things take place. It is up to the engineer to use the findings of the chemist to the best practical advantage. By looking at the training that the chemical engineer receives we can readily realize that he must be very different from the chemist. The engineering schools of this country agree that the chemical engineering course must be a general course giving the man a background of general chemistry, physical chemistry, organic chemistry, electro-chemistry, analytical chemistry, and metallurgy. For the engineering phase they offer courses in pyrometry, processes used in the chemical industry (such as drying, filtering, centrifuging, etc.), drafting, general engineering, etc. Most of the schools have courses in electricity that would be available to the chemical engineer; these courses include the study of the

laws of direct and alternating current, the laws of the motor and generator and their construction, laboratory studies on how to hook up meters, motors, and generators. There is no necessity to explain why the man who follows electro-chemistry should pursue this course, and many of the universities do include this study in the chemical engineering course. They do not feel specialization is good for the student; their aim is to turn out a jack-of-all-trades in chemical engineering, and when the student finds a place in industry he can become master of his job in a very short time.

These then are the men who will be looking for a place within the plating industry. We are already aware of the necessary duties performed by engineers in such roles as laboratory research workers at the Bureau of Standards and at the supply houses and as salesmen and technical advisers. Now let us consider the part these men can play in our plating shops. The first job that the chemical engineer should have in the plating room is to systematize the processes already going on. In other words, he should analyze all solutions, do it regularly, and provide a setup whereby additions to the solutions may be made regularly also. This function is elementary and is one that is recognized readily when we speak of the technical man in the plating room. In fact, all too often this is thought to be the only job the technical man is useful for in the plating room. He should conduct or set up thickness control tests so that the articles plated may meet specifications and the plating solutions may be operating at their utmost efficiency at all times. He should also conduct salt spray and corrosion tests and any other tests that the specifications might require. In this part of his work he can be of immense help to the cost department; knowing the thickness of the plate and the area of the piece, he may figure the amount of plating on it, or he may conduct strip tests to find the weight of the coating. He can help in the design of racks so that the pieces may have the best current distribution, so the thickness of the plating may be as uniform as possible. He can also act as a buyer's guide for the foreman plater. By this I mean that when a new cleaner or a new process comes on the market he can set up pilot tests whereby he can satisfactorily gauge the value of each new product. All too frequently we hear the complaint that the articles appearing in our trade journals are

too technical for the average foreman plater and this complaint is not without reasonable justification. Often we are tempted to suspect that the authors of some articles cannot themselves understand what they are talking about. However, the chemical engineer, having been trained to understand the special vocabulary and science of plating, is able to interpret these articles so that the foreman plater may get the full benefit from those articles and apply them to his work. He can also conduct exploratory or pilot tests on the various processes that may be mentioned in these technical articles. This is especially important because where the foreman is limited in time and in ability to experiment, the trained engineer can make more efficient use of these available materials by experimenting with them separately and on his own time. Of course, he should always be called in when any trouble occurs in the plating room, because the old adage, "Two heads are better than one" still holds, especially when one has the theoretical and scientific background and the other has the practical.

Certainly these functions justify the presence of a trained engineer in any shop having a plating department. But these do not by any means limit the potential usefulness of a trained chemical engineer to a company. He can also be employed to do various other jobs in the factory. He may control the alloying of various metals both by recommending the types of mixes to be used and by analyzing the finished products. He can check all temperature indicators and controllers and also repair these instruments. He may also help the heat treater by analyzing and controlling his cyanide hardening baths. Having training in metallography, he can also help the heat treater by checking the depth of the case obtained by carburizing or cyaniding and he can also inspect the steel before or after it is heat treated so that the right product will be obtained. He can also help by controlling the raw materials coming into the plant, by analyzing for special constituents or properties in those raw materials, such as the carbon in steel, lead in brass, and the grain size in steel, stainless steel and brass. If there are soldering operations in the plant he can also help there by making up special fluxes and solders. He can also conduct corrosion tests on the paints that are used in the factory and determine which are suitable for the particular jobs. And last, but not least, he

can act as liason man between the plating department and the other departments in the shop, because the variety of his duties puts him into closer contact with the different departments of any factory and his organization experience better qualifies him for adjusting problems when they affect two or more other departments.

The previously mentioned duties are too numerous for any one person to handle. However, many of these are not encountered in the same shop at the same time and if they were, more help would have to be given to the chemical engineer. However, the employment of better equipment may help solve the problem of getting more work out. I would like to illustrate this point of equipment with a story: A professor who was conducting a psychology class asked members in the class what they would rather do, take out a girl or dream about one. All except one answered they would rather take a girl out. The professor asked the remaining one why he would rather dream about the girl instead of really taking her out. The young student promptly answered "When you dream about them you get a much better class of women." Thus it is with equipment all too frequently. If you dream about it you obtain some very good stuff, but all too frequently the average laboratory in the commercial plant is under-equipped. Management, it seems, is not willing to spend money unless they can see some immediate returns from it. The chemical engineer needs tools to work with just as well as the machinist or tool and die maker.

I know that many of the foreman platers think that the college man will soon replace them and take away their jobs. However, this is not the case and I want to bring forth a few points that should serve to allay their fears. We may draw an illustration from three well-known industries: paper, beer, and leather. In all three of these we use chemical means to obtain a product that can only be measured by the senses of man. In other words, there is no way to measure concretely the texture of paper, the taste of beer, or the feel and appearance of leather. These measurements can be made only by one whose senses are trained to make them. The same is true in plating; there is no concrete way to measure the appearance of a plated article, which after all is the criterion by which we judge the plated piece. In the paper, beer, and leather industries, we had in the early 1900's

practical men who were able to produce these articles without the aid of technical men. However, as soon as the technical man invaded these three fields and helped the practical men, they produced better paper, better beer, and better leather. He has not taken their jobs, he has enhanced them, because he has expanded these three industries so that there is room for both the practical man and the technical man. The chemical engineer controls the chemical processes in these industries and the practical man, being the only one who can really measure the final product, must still be employed so that he may control the appearance, the taste, and the feel of the paper, beer, and leather respectively. To further illustrate, let us look at the paper industry in 1910. Paper, as such, was the only article manufactured. However, since that time, paper in many forms —Kleenex, paper napkins, insulation in your homes, paper cups, wax paper, crepe wadding, paper towelling, and better paper in general—has come on the market. These new products are the result of the advent of the chemical engineer into the paper industry. Thus we can assume that they will provide newer products of plating and newer uses so that our industry may become greater and there will be jobs for all of us.

In behalf of the chemical engineers, both present and future, I wish to thank you for the courtesy you have extended to them in reading their case.

LOS ANGELES BRANCH ANNUAL PICNIC

The annual Picnic of Los Angeles Branch of the A.E.S. was held July 20, at Montebello Park in Montebello, California. One of the principal features of the day was the Membership Trophy, which was displayed for the first time to the Branch members and their friends. The Branch is very proud of this beautiful trophy and we are determined to make every effort to increase our membership as much this year as we did last year. After lunch, which John Merigold watched the rest of us eat (Mrs. Merigold left the sandwiches home in the refrigerator), the group left the stripped tables and assembled on the lawn for the customary games and races.

The first event, a three-legged race for men, was won by Gene Rynkofs and Lester Belger. This is the second time this team has won this event. Next year they'll have to put both legs in the sack. The shoe-kicking contest for the ladies was won by Betty Foote, and for the men by Oscar Johnson. After a number of other races the semi-final event was staged, a pie-eating contest which was won by Jimmy Darnold. Jimmy entered but did not do so well in the final event which was won by Josephine Shatura. Jimmy placed. The event?—a watermelon eating contest.

The men on the committee responsible for this picnic were C. C. McLaren, Bruno Schindler, Milan Cahoe, Charlie Russill, Clarence Thornton, Ray Vasquez, Delos Eldered, Gilbert Bishop, Stanley Rynkofs, Emmett Holman, and Earl Coffin.

ERVIN FRAUENHOFF, *Secy.*

Plating Room Control

Rochester Branch Educational Lecture
By C. N. HENDERSHOTT
Bausch & Lomb Optical Company
Department of Chemistry

IN spite of the fancy title, I intend to be entirely practical in the hope that some of the smaller shops may become interested in Plating Room Control, for no matter how small or poorly equipped a shop may be, there is some phase of control which will be practical and economical. In the early days of plating, little was known of the chemistry and physics of plating. The plater was very nearly pure artist. For success, he depended on his five senses and a generous amount of the sixth sense. The early solutions, however, were continually going wrong, mainly because not enough was known about them. In his efforts to put plating on a sounder basis the early attempts at control had their beginnings.

For example, as soon as it was known that temperature was a vital factor of alkaline cleaning, the plater accordingly examined the efficiency of his cleaners until a working range was selected. He then proceeded to maintain this temperature range either by taking the temperature with a thermometer or by observing the quantity of the steam arising from the heated solution, then adjusting the steam valve. Control, therefore, is a natural controlled development in any process. It is part of the initial trend in the histories of all successful chemical or physical processes.

Control may be defined as the adaptation of physical and chemical standards to a practical process in such a manner that the process continually functions in a successful manner. This does not mean, however, that control is something magically removed from the technical high hat, but rather the simple regulation of the fluctuating constituents in order that successful operation may be continuous. Control may be as simple as that used to maintain a standard temperature by use of a thermometer with steam valve or it may be highly complicated to necessitate chemical analysis or difficult physical observations.

Control depends for its existence on its ability to save money and improve quality. If control is not paying dividends in your plant, then it has no place there. It is likely, however, that if you are not receiving economical benefit by the use of process

control, the fault lies with you. Keep in mind the fact that control is something which must be designed to meet the characteristic conditions of the individual plating shop. What may be considered practical control in one plating room may be unwarranted expense in another. In discussing this subject it must be divided into two fundamental steps — first, specification, second, maintenance. For some reason or other many platers have the misconceived idea that control consists only of testing and nothing need be known regarding the limiting values of the process in question. To have any control at all, we must first derive a good working formula for all items involved in the process. It is essential that the process be carefully observed so that high and low values for each variable needing control may be determined. To give a simple example, consider the time element in electric cleaning. We may by observation determine just how short a time it takes to produce satisfactory cleaning, and just how long a time elapses before overcleaning develops. We may now specify the exact limits for satisfactory cleaning, such as one minute to two and one-half minutes. This simple experiment provides us with the necessary information for the specification of the time variable in an electric cleaner. To maintain a solution that has been duly specified, on the other hand, requires that we provide ourselves with some means of measuring each variable so that we may make the necessary arrangements to keep within the limiting values of the specification. In a simple case we might consider temperature where it is only necessary for us to require an operator to check the temperature with a thermometer at specified intervals that he may assure himself that sufficient steam is being supplied for the maintenance of the optimum temperature range.

Considering process control in a larger sense, we must include not only the actual control of the tank itself, but also control of purchased materials, and finished parts. In discussing purchase control, we must keep in mind that a very real part of our budget is set aside each year for the purchase of plating chemicals and supplies. We are fortunate in having a great deal of reliable information in the literature regarding the specification of plating chemicals and supplies. In most cases, we may consult the literature of the A.S.T.M., A.E.S. and others, and write a satisfactory specification for such items as nickel salts, anodes, etc.

After the specifications have been written either from the literature or through actual experimental determination in the plating room, the problem of maintaining these specifications arises. Certainly in the smaller shops it is not economical to test the quality of purchased materials. We may, however, select suppliers whose integrity is beyond reproach, and thereby assure ourselves of products whose quality meets our specifications. In some of the larger shops, however, the volume of purchased materials is so large that savings may be made by purchasing from a wide market. In this case testing is advantageous. There are several advantages in control as applied to purchased materials. Certainly, it is a great aid to the purchasing agent because by presenting him with a specification for requisitioned materials you have informed him exactly of your requirements. The supplier likewise is in a better position to supply you with exactly what you desire for he has a specification which has been carefully prepared for the material in question.

If control is actually applied, you will find that the investigation necessary will reveal that in some cases the quality of materials which you have purchased in the past is beyond the needs of the plating room, and a saving will result if lower grade materials are purchased. In other cases you may be able to trace certain inherent difficulties in your process to the use of too low quality materials, and will again benefit by the substitution of satisfactory specifications.

We must now consider some of the problems of control existing in the plating process proper. To simplify the discussion, it seems advisable to divide the process into several general units, organic degreasing, alkaline cleaning, cyanide and acid dips, and plating baths. In each case, let us not only include the chemical values but also the physical conditions, such as time, temperature, and current density necessary for good process operation. It would be impossible to cover this field completely, so let us limit this discussion to a few remarks concerning alkaline cleaners and plating baths. Cleaners, whether they are of the soak or the electric variety, present rather a complicated set of conditions for control. Today a large number of plating shops are using proprietary cleaners whose composition is not definitely known to the plater. Cleaners are selected on the basis of performance and cost. Once a cleaner has been selected, the problem of

keeping its solution in workable order arises. The variables chosen for control must be effective yet simple. The most important variables are effective alkalinity, pH, concentration, process, time, temperature, current density, and maximum dirt load, or dumping schedule. By first specifying these variables and then maintaining them it is safe to assume that we will have a more continuously operating cleaner. This does not mean, however, that trouble is forever dispelled from cleaning, but rather that the most frequent causes of failure have been eliminated. To make this particular example more concrete let us assume a hypothetical cleaner, and first specify it and then develop a maintenance schedule. The values noted below are purely hypothetical and bear no relation to any standard cleaner:

Tank #1—100 gallon capacity
Total charge of cleaner—25 pounds
Concentration—4 oz./gal.
pH—10 to 10.5
Effective alkali—1 to 1.2 oz./gal. NaOH
Temperature—180 to 210°F.
Time—one minute direct current, 5 minutes reverse
Current density—35 to 45 amps./sq. ft., approximately 6 Volts
Average satisfactory life—120 hours.

In order to write such a specification for a cleaner it will be necessary, of course, to carry out a series of experiments or observations under controlled conditions; that is, we must know for instance that poor cleaning results under a temperature of 180°F., and that loss by evaporation is too great above 200°F. Likewise, every other variable must be considered. In some cases, it will be necessary to make a series of analytical checks in order to find out just what values represent the limiting values of the cleaner. The success of any control system depends mainly upon the accuracy of the information compiled for the writing of a specification. Successful maintenance can be no better than the specified limits derived before the control system is applied. To maintain a cleaner in satisfactory working order, it is necessary to evolve a system of maintenance. For concentration, for instance, we might provide for the analytical determination of free caustic weekly, and from this information calculate the amount of cleaner necessary to bring the concentration within the useful range.

As specified above, we must provide for some means of maintenance for each variable. We might list them as follows: Analysis every 30 hours of operation for pH and effective alkali, calculate the necessary quantity of cleaner to be added, and issue such an order. Temperature is maintained manually by observing the floating thermometer. Process time, either by counting or observing the second hand on the clock. Dump the cleaner and clean the tank every third forty-hour week. Regulate the current density by applying 6 volts across the bus bars of the cleaner. By using such a system as noted above, we are in a position to predict satisfactory service from the cleaner.

We have not, however, covered every possibility so that occasional cleaning difficulties will arise. It would not be practical or economical to so completely control the cleaner that no difficulty, however small, might arise. We can only hope to control those variables which most often cause trouble.

The plating tank proper is probably the most important individual unit in the plating room. We may expect greater dividends in the application of control to the plating solution than through its use in any other part of the plating process.

Plating solutions are for the most part complicated solutions and have much narrower limits than many of the other units of the plating room. For the sake of example, consider an ordinary Watts bath. It should be said at the outset that while there are a large number of articles in the literature recommending certain variations of Watt's original formula the one which works best in your plant is slightly different in one or more other constituents. Your Watts bath has probably been adjusted to meet the special requirements of your own plating practice. If a series of analyses are made over an extended period of a month to a year there will be ample opportunity to observe the actual working of the bath under known conditions of formula. You will have at hand then the information necessary for the specification phase of process control. For a concrete case, let us note the following working formula which might result from several months of study under known formula conditions:

Nickel	6 to 6.5 oz./gal.
Nickel chloride	4.8 to 5.2 oz./gal.
Boric acid	4 to 4.5 oz./gal.

Wetting agent to give 40 to 45 dynes/cm. surface tension

Temperature	100 to 110°F.
Current density	15 to 20 amp./sq. ft.

To maintain these values, it is necessary to carry out practically the same series of analytical checks as was used preparing the data for the specification. We must be careful to select the intervals between analyses so that at no time does the solution exceed the limits of the specification. Some variables, such as pH, for instance, will have to be checked very frequently in order to calculate additions necessary for the proper maintenance of the solution. Other constituents, such as boric acid which is lost mainly by dragout, will have extended intervals between analyses.

Control of a nickel bath presents a somewhat difficult problem to the small shop which does not have laboratory facilities. There are, however, a number of simple test sets on the market which the ordinary plater can operate in the plating room very successfully. These test sets are for the most part inexpensive and will pay for themselves many times in the course of a year. An excellent way to reduce the amount of necessary chemical analysis is by the use of an ampere-hour meter. Ampere-hour meters were first used in the silver plating industry as a means of controlling the weight of silver plated on the silverware. Because this instrument measures the amount of electrical current passing through the plating tank, it is possible by calibration to figure out at what rate the certain plating chemicals are used up. Even dragout bears a certain rough relationship to the amount of plating done in the tank if the articles are of a general shape and size. For example, in a bright nickel bath using an organic brightener it is possible for a series of tests to determine just how much brightener to add per ampere hour of operation. Under this condition it would only be necessary to analyze for brightener concentration approximately once a month in order that the solution may be completely corrected for this constituent. As a matter of fact, nearly every constituent used in a nickel bath can be roughly controlled by the use of an ampere-hour meter. This instrument is being successfully used by an increasing number of platers.

Passing now to finished work control specifications, for the most part either the designer or the purchaser of the plated part specifies such items as thickness, salt spray life, porosity, and

adhesion considered. But if the plater is called upon to select specifications for a certain class of work he will find a great deal of help in the literature. Of particular note are the Bureau of Standards publications which resulted from the comparative research of the American Electroplaters' Society and the Bureau of Standards. In order that these specifications may be enforced, it is necessary to occasionally test plated parts selected from the regular production. Method of tests have been listed in many of the plating publications and need not be dwelt upon here. It is the job of the plater to maintain the quality of his product as defined by the specifications, and he must, therefore, correct the existing conditions in the plating room so that production is at all times within the limits set in the specifications.

In conclusion, I would like to state again the most important factors of control: First, control depends upon specification and maintenance, second, control must produce better quality at lower costs. Third, even a small shop may apply process control. Fourth, control is not a cure-all but rather a means of eliminating certain reoccuring difficulties.

RADIANT-HEAT BAKING

Practical finishers, interested in the radiant-heat, or infra-red, process of baking organic finishes, may obtain copies of a new bulletin on "The Uses and Limitations of Radiant Heat for Baking Organic Finishes," from Maas & Waldstein Company, makers of industrial finishes, 438 Riverside Avenue, Newark, N. J.

The publication, written by G. Klinkenstein, Vice-President and Technical Director of Maas & Waldstein, discusses conditions for the efficient use of radiant heat baking, finishes for use with the process, and other matters of importance to the finisher. Copies are available to users of finishes on request.

PUT FRUIT JUICES, DRINKS IN GLASS CONTAINERS

"Don't put fruit juices or gelatines which may be flavored with fruit juices in metal containers. Instead use glass or porcelain dishes or receptacles for such food products." That is the warning issued by Dr. L. Jackson Smith, health commissioner, to housewives as the result of reports of several instances of cadmium poisoning in New York. The poisoning is attributed to use of containers plated with cadmium. Because the average person cannot tell whether a metal vessel is coated with cadmium or chromium, Dr. Smith advises that use of metal containers be avoided.

Cadmium poisoning may not be fatal, but will cause acute gastritis for periods of from 24 to 48 hours. The onset of the attack comes quickly, within 15 to 20 minutes after reception of the drink or gelatine dessert that may have been in a cadmium coated container.

In a recent article in the American Medical Journal, there was an article citing cases of four families in New York that had been poisoned and suffered acutely from the cadmium poisoning and now New York City has passed legislation forbidding the use of cadmium as a plating for metals which may be used in making vessels to be used as food containers.

THANKS TO YOU!

Grand Rapids Welcomes You in 1942

The Grand Rapids Branch thanks you for selecting our city for the 1942 convention.

All committees are hard at work and plans are progressing nicely to give you the best in *Speakers*, *Comfort*, and *Recreation*.

We are sure that you will find our facilities excellent and our hospitality unexcelled.

Plan now to be with us in 1942.

Cordially,

Your Convention Committee

AMERICAN ELECTROPLATERS' SOCIETY

NATIONAL CONVENTION

GRAND RAPIDS · MICHIGAN · JUNE *8 TO 11, 1942*

For those *Afterhours* of *Essential Recreation*.

Last Minute Developments *in* Plated Aluminum

By RAYMOND F. YATES
Vice President, Krome-Alume Co.
Delivered at Boston Meeting of American Electroplaters' Society, May 1, 1941

PRIOR to the appearance of the Krome-Alume process for plating aluminum and its alloys, deposition over this metal from any of the ordinary cyanide solutions did not extend beyond laboratory application; and interest in the matter, due to limited technical considerations, was largely academic. Some work had been done in connection with the application of cadmium but it was not very convincing and apparently no large scale commercial applications were made. Copper could also be applied under certain restrictions but, in the case of copper next to aluminum, the union of the two metals was usually held in suspicion because of the wide separation of the metals in the scale of electrochemical equivalents. Brass for similar reasons was also held suspect.

Certain very substantial reasons, however, can be advanced for the use of such good protective metals as zinc and cadmium directly over aluminum. Both of these metals are very close to aluminum in the electro-chemical scale and they both offer superior resistance to corrosion under average conditions. Some authorities hold that a well-adhered deposit of cadmium over aluminum in sufficient thickness will be superior to even the best anodic films. Not only can zinc and cadmium be useful for the protection of aluminum but also for purposes of soldering where ordinary soldering materials and devices may be employed. Silver deposited over aluminum also makes the latter available for certain electrical contact applications.

Although the Krome-Alume process, at the time of its introduction, was instantly successful in effecting a high degree of adhesion between aluminum and nickel, it was admittedly deficient in effecting deposits from cyanide or alkaline solutions of any kind except where rather heavy deposits of nickel had been made first for matters of pure protection. If the basis deposit of nickel was too thin, the cyanide solution would bite through and seriously interfere with the deposit of nickel itself.

This feature will be readily understood by those who know anything about the chemistry of anodic films. Anodic formations of all kinds are extremely sensitive to attack by cyanide solutions and exposures of short duration can not only greatly damage anodic films but can completely remove them if the cyanide concentration is high enough.

Inasmuch as the Krome-Alume process is initiated by establishing an anodic film which is subsequently modified, the nature of a modifying agent is very important. Prior to the discovery of certain improvements in the Krome-Alume method, cyanide solutions were commonly used for the modification of the anodic coat. It is necessary, however, to bring this treatment under rather rigid control and for some reason not as yet clearly understood, anodic films that were modified in cyanide solutions fail to receive adherent deposits when plated in any of the common cyanide solutions. This is due perhaps to a weakening of the anodic film by direct attack before any appreciable amount of the metal could be deposited. At any rate deposits so formed were weak and inadequate.

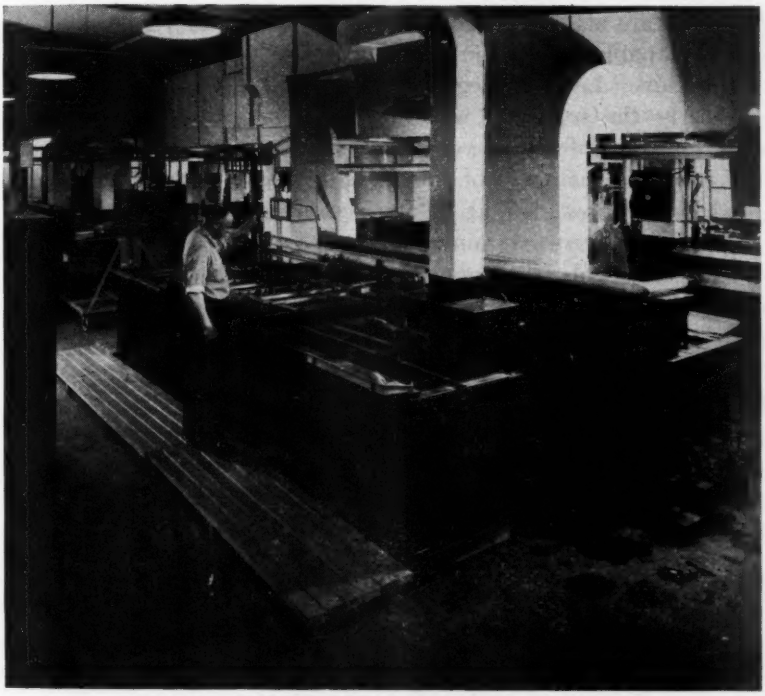
Due to the development of new acid solutions for the modification of the anodic coat, plating direct from cyanide solutions may be accomplished without any trouble whatsoever. By means of this new method, it is possible to plate from all of the common cyanide solutions such as brass, copper, silver, etc. In one instance, however, where the pH of a certain new brass solution ran extremely high, trouble has been encountered, but this can be overcome by first flashing the aluminum in a brass solution rated at an ordinary level of pH.

Aluminum articles plated directly from cyanide baths are beginning to find wide use. One of these uses comes from the mechanical goods division of the rubber industry. The rubber people have long sought a cement that would fasten rubber to the surface of aluminum articles with a high degree of adhesion. Although a lot of progress has been made in this line, even the best cements were incapable of establishing adhesion that could not be disrupted by the application of forces in excess of 700 pounds to the square inch.

The rubber industry has felt for some time that rubber adheres well to metallic surfaces that have been plated with brass. While the chemistry of this is not fully understood, it was known

that the adherence produced on metals like steel was greatly in excess of that obtainable by any form of cements.

During recent years, especially in the aircraft industry, there has been a demand for rubber-covered aluminum articles, but here the brass could not be plated over the aluminum with any



KROME-ALUME, INC.

degree of safety until the improvements in the Krome-Alume process made this possible. Brass is now being plated over this metal in substantial commercial quantities and both with and without nickel. Whereas cements were not able to stand up under tensile strength tests that exceeded 700 pounds per square inch, brass plated aluminum has been able to withstand tests that run as high as 3610 pounds per square inch which was the rupturing point of the particular samples of rubber used. In every case the rubber ruptured and the plating was left intact

so that it is not known at what point the brass plating will be torn from the surface of the aluminum.

Recent applications of copper directly to aluminum have shown the way to a cheap and effective method of soldering aluminum articles by the use of ordinary equipment. It is estimated that aluminum can be prepared for this service at a cost that does not run much beyond a cent and a half per square foot. When such deposits are made, either from acid or cyanide solutions, they are quite capable of standing up under the sudden application of six or seven hundred degrees of heat and if the plating is done properly the soldering will invariably rupture before there is any tendency of the copper to leave the surface of the aluminum. Of course in instances of this kind it is barely possible that the high heat causes a slight fluxing action between the copper and the surface of the aluminum.

A great deal of aluminum radio aircraft equipment where fabrication is brought about partially by soldering is now being produced through the agency of the Krome-Alume process. This application has been approved by both the United States Army and Navy.

During the past year aluminum has been brought to a position where it can now take its place beside all of the common metals in so far as deposition is concerned. With the single exception of extremely high pH cyanide solutions that run at elevated temperatures, there is no solution used on common metals that cannot be applied to aluminum surfaces that have received the Krome-Alume pre-plating treatment.

BATTELLE MEMORIAL INSTITUTE EXPANDS

A fourth major building expansion program in recent years is under way at Battelle Memorial Institute, Columbus, Ohio, where a 160,000-dollar addition to the process metallurgy laboratory building is under construction. Because of current world conditions and the resultant emphasis on the development and utilization of domestic raw materials and substitute materials, research by American industry has greatly increased, Mr. Williams stated. Current research investigations at Battelle are instituted partly by industries closely associated with the defense program and partly by those industries that are anticipating the adjustments of the post-emergency period with new and improved products and reduced production costs.

Battelle Memorial Institute is one of the country's larger industrial research organizations. It carries on fundamental and applied research in ferrous and non-ferrous metallurgy, ceramics, physics, organic and inorganic chemistry, fuels, coal preparation and utilization, ore-dressing, and materials concentration. Research is done both with its own funds and for industrial sponsors.

The Fundamentals *of* Electrochemistry *and* Electrodeposition

I. The Formation of Simple Ions

By SAMUEL GLASSTONE, Ph. D., D. Sc.
Princeton University

Importance of Ions

IF we were asked to explain in the simplest terms the processes of electroplating or electrodeposition, we should say that they consist in the passage of an electric current through a solution and the separation of a metal on one of the electrodes. Both of these fundamental processes depend on the existence in the solution of charged particles known as "ions." An ion is an atom or group of atoms that has acquired an electric charge; this charge may be positive or negative in sign. These ions carry the current through the solution, and when they give up their charges at the electrodes, the resulting uncharged material will, in certain circumstances, form a "deposit" or "plate." It is clearly important for us to try to understand something about the nature and properties of ions.

The Structure of Atoms

According to modern views, every atom consists of a small nucleus carrying a net positive charge surrounded by a number of negatively charged particles, known as "electrons." The number of electrons around the nucleus of any atom in its normal or neutral state is equal to the positive charge on the nucleus. The resultant charge of the atom as a whole is, therefore, zero. The nuclear charge, and hence the number of electrons surrounding the nucleus, increases steadily with increasing weight of the atom. For example, the nucleus of the atom of hydrogen, the lightest known atom, carries a single positive charge and there is a single electron moving round it. The next heaviest elements in order are helium, lithium, beryllium, boron, carbon, etc., and their nuclei carry two, three, four, five, six, etc., charges, which are surrounded by the same number of electrons, respectively. The nuclear charge and the number of electrons increases

steadily until with uranium, the heaviest element, there are 92 electrons around the nucleus.

We now have to consider the question of the arrangement of these electrons which surround the nucleus. There are reasons for believing that these electrons form a series of groups or shells, each of which is capable of holding a definite maximum number. The actual numbers need not concern us here, but what is important to note is that certain groupings of electrons confer special stability on the system. The first stable group contains

DR. GLASSTONE

two electrons, as for example, in the helium atom; helium is known to be an exceptionally stable and non-reactive gas, and this is attributed to the group of two electrons. After the first electron shell, special stability occurs when the number of electrons in the outermost group is eight. This condition arises with the inert gases neon, argon, krypton, etc.; in each case the innermost shell contains two, and the outermost shell has eight electrons. The numbers in the intermediate shells vary according to certain definite principles which are, however, immaterial for our present purposes.

The Formation of Singly-charged Ions

If the atom of a given element has one electron less than that corresponding to maximum stability, there will be a tendency for an electron to be gained from a suitable source. When this occurs the system carries one negative charge in excess of the positive charge on the nucleus; the whole has therefore a unit negative charge and is, in fact, a singly-charged negative ion. The formation of the univalent chloride, bromide or iodide ions, i.e., Cl^-, Br^- or I^-, can be accounted for in this manner. When arranged in order of increasing number of electrons, each of the elements chlorine, bromine and iodine immediately precedes an inert gas, viz., argon, krypton and xenon, respectively. By acquiring an additional electron the chlorine atom, for example, attains the complete electronic shell which is responsible for the stability of the inert gas argon. If conditions are suitable, there will thus be a strong tendency for a chlorine atom to become a singly charged, negative chloride ion. It should be noted that the chloride ion differs from the argon atom on account of the difference in their nuclear charges.

On the other hand, if an atom of an element has one electron in excess of the stable number, this electron will endeavor to leave the atom. If this happens, the resulting system as a whole has one positive charge more than the number of electrons; in other words, it is a singly-charged, i.e., univalent, positive ion. The elements sodium and potassium, which succeed neon and argon, respectively, thus tend to form the ions Na^+ and K^+. The reason why the elements sodium and potassium react so violently with water is that the atoms are acquiring the extra electron in each case which will confer greater stability on them. The reaction with water thus involves the conversion of the reactive, unstable atom of sodium or potassium into the stable Na^+ or K^+ ion.

Multiply-charged Ions

So far we have discussed only those atoms with one electron less or more than the number associated with maximum stability. Similar considerations apply to elements having two electrons less or more than the complete shell of eight; these will tend to form negative or positive ions, respectively, carrying two charges. The existence of the bivalent negative ions O^{--} and S^{--}, and especially of the positive ions Ca^{++}, Sr^{++} and Ba^{++},

can be accounted for in this manner. The tendency for electrons to leave the atom is generally greater than for them to be gained. For this reason triply-charged negative ions in solution are unknown, although trivalent positive ions, such as Al^{+++}, exist. The stability in the latter cases is favored by combination with water molecules. This question of the "hydration" of ions will be considered in a later article.

Ions and the Periodic Table

In concluding this section, we will reproduce a part of the Periodic Table of the elements. As is well known, in this Table the known elements, with a few exceptions, are arranged in order of increasing atomic weight, and hence in order of increasing number of electrons. It is found, as may be expected, from the repetitions which occur in the electronic arrangements, that the chemical properties of the elements repeat themselves at definite intervals, thus giving the so-called "groups" of the Periodic Table. We give below a section of the Table consisting of two or three groups on either side of the highly stable inert gases (Group 0). The elements in Groups VI and VII require two

Group	VI	VII	0	I	II	III
	O	F	Ne	Li	Be	B
	S	Cl	A	Na	Mg	Al
	Se	Br	Kr	K	Ca	Ga
	Te	I	Xe	Rb	Sr	In

and one electrons, respectively, to attain the stable electronic configuration of the elements of Group 0; we thus find that these tend to form bivalent and univalent negative ions, respectively. On the other hand, the elements of Groups I, II and III have one, two and three electrons, respectively, in excess of the stable number; these elements thus form positive ions of valence one, two and three, respectively.

THE RESEARCH COMMITTEE

Mr. Erwin Sohn, chairman, writes that the personnel of the 1941-1942 Research Committee is now complete. It stands as follows: A. B. Wilson, Frank Mesle, Carl Heussner, E. T. Candee, E. S. Taylorson, R. O. Hull, T. F. Slattery, W. J. R. Kennedy, Erwin Sohn, E. A. Anderson, F. J. MacStocker, Joseph Downes, Dr. William Blum.

Industrial Skin Diseases

CONSIDERING the problem of Industrial Skin Diseases as a whole, we divide the causes of skin irritations into a simple classification of two divisions:

1. Mechanical and Physical Irritants:
   Cuts, abrasions, pressure, heat, cold, radiation, (both natural and artificial).

2. Chemical Irritants:
   These are divided into two sections, general and specific irritants. The general irritants are those chemicals which will affect all individuals and the specific irritants which will affect the skins of certain hypersensitive individuals.

The Chemical Irritants may be divided into organic and inorganic. The Inorganic irritants can be subdivided into Acids and their Salts, Alkalies, and the salts of irritant metals.

The Principle inorganic irritants are Sulphuric, Nitric, Hydrochloric, Hydroflouric, Chromic and Arsenous. The principal irritant alkalies are Sodium and Potassium Hydrate, Carbonate, Calcium Oxide, and Calcium Hydrate. The principal metals which have irritant salts are Mercury, Chromium, Silver, Nickel, Zinc, Arsenic, Antimony and Phosphorous.

The Principal Organic Irritants generally, can be divided into Organic Acids and their Salts and organic Solvents. The principal Organic Acids which may cause Dermatitis are Oxalic, Carbolic, Cresylic, Formic, Acetic, Hydrocyanic and Abietic. The principal organic Solvents which may cause Dermatitis are the various Alcohols, Turpentine Amyl Acetate, Benzol, Carbon Bisulphide, Carbon Tetrachloride, Trichlorethylene, Butyl Acetate, Toluol, Gasoline and Solvent Naptha.

2A. Specific Irritants are those that cause Dermatitis only on certain hypersensitive individuals and the list is a very long one. Principally are the Dyes and their intermediates, Napthalenes,

Nitro Compounds, Leather Dyes, Photo Developers, and certain Soaps of high alkalinity, especially those containing Phenol or Cresol for disinfectants, Fabric Dyes and Rubber Compounds. Also included are the compounds used for explosives. Even Vegetable and Mineral Oils are among this list, and that is why some Cosmetics cause severe cases of skin troubles.

Of the above list, the electroplating industry is concerned with only a small portion of these hazards. These of course you are acquainted with, the Acids, used in the plating operations, and the Solvents used as Metal Cleaners and Degreasing Agents. These hazards should be considered under three simple classifications:

1. Hygiene 2. Engineering 3. Protective Equipment

These three divisions of skin prevention are equally important generally speaking, but vary according to the industry and hazards that are involved.

While the business of the Milburn Company is to manufacture protective material, it would be folly on our part to disregard the other two very necessary considerations, primarily because our material must be definitely dovetailed in performance with the other conditions in order to perform satisfactorily and give efficient service. I will explain this particular circumstance a little later.

Our work of developing protective materials takes us into plants where conditions and manufacturing processes vary so greatly, that in order to do our job properly, our viewpoints must take combined considerations of the Industrial Doctor, Hygienist, Chemist, Safety Engineer, Production Superintendent, the foreman and the employees. When we take into consideration the thousands of various types of industries and add to it the fact that there are about 1600 known chemical irritants used in Industry of varied degrees of toxicity, it sometimes becomes very difficult to stimulate conditions under which our material are to be used.

Regarding the Electroplating Industry, I wish to acknowledge a very splendid article that recently appeared in the magazine, Occupational Hazards and Safety by Mr. M. J. Moll of the

Hanson-Van Winkle-Munning Co., of this city, under the heading "Hazards and Safety in Electroplating".

Mr. Moll lists a rather complete schedule of Health and Accident hazards of the Industry. Mr. Moll also appears to be sold on the potential value of Protective Creams and Ointments as a prevention for skin irritations, but "recommends the use of protective ointments, especially compounded for the specific irritants". And that is a very important specification.

There are three factors to be considered when we speak of skin hazards in your industry, and Dermatitis is not the correct diagnosis of all of them. The first and only one where this diagnosis is absolutely correct, is where the plating acids cause so-called Nickel Itch, Copper Itch, etc. These are cases of hypersensitivity or Allergy, or a predisposing condition exists.

A Dermatitis develops in such cases that sometimes becomes chronic and often incurable. This is a very expensive experience for the employer and the Insurance Company, because Medical Costs are very great in these cases and they may last for years.

The other hazards that may cause Dermatitis are the Degreasing and Metal Cleaning Agents, The Hydro-Carbon Solvents such as Carbon Tetra-Chloride and Tri-Chlor-Ethylene. But, the greater hazard from these two agents aside from the possibility of fume inhalation is the skin absorption of these chemicals.

In the technical section of our Literature, our Research Studies on animals have proven conclusively, that there is definite and dangerous destruction of Red and White Bloods Cells, and a reduction of the Hemoglobin as a result of the absorption of these Hydro-Carbon Solvents. Hemoglobin is the ability of the Blood Stream to generate it's own oxygen in addition to that which we breathe. In other words the effect is the same as by inhalation of the fumes, but its effect is slower, and cumulative over a period of time.

The other hazard is the effect of the Acids on the abrased areas of the skin or penetrating into open wounds. These develop into so-called Ulcers, which heal at the surface, but a hard core forms underneath the skin, and is very painful and difficult to heal. There have been numerous cases of amputations necessary as a

result of the inability to heal such Ulcers, and it is highly important that skilled first-aid treatment be given promptly in all such cases.

So much for the hazards.

As to prevention, Hygiene, is probably more important in other Industries than in the plating processes insofar as skin irritants are concerned. The accumulation of dirt and solid matter in the pores and hair follicules is more probable where oily, greasy operations are concerned than where Acids or Solvents are used, but nevertheless, Hygiene must be encouraged at all times.

Engineering of course is very important, and I am only treating it as it relates to skin hazards. Proper Ventilation is necessary, because of the possible cases of sensitivity to irritations from Acid and Solvent Fumes. These Chemical Fumes are often irritants not only to the workers employed at the actual job where the fumes originate, but if they carry into other parts of the building, workers in other departments may be affected. Hence the ventilating factor is of utmost importance, because in such cases, you can hardly expect employees to cover themselves from head to foot with protective ointments to prevent irritations. And inasmuch as fumes will carry through and underneath wearing apparel, that is just what would have to be done.

As to protective material, each job must be analyzed according to its requirements. Protective Ointments in Acid Hazards, must be Acid Proof. That they are Acid Proof, must be substantiated in no uncertain way. (As Mr. Moll stated, they must be specially compounded to serve the specific purpose for which they are intended.)

Sometimes, they cannot be used because they may contaminate the product that is to be plated, and prevent a perfect Plating Job. If gloves are used, proper Ointments are an additional precaution, if Acid splashes or runs down into the glove. Other instances are experienced where workers especially sensitive or allergic, cannot wear rubber gloves, because attendant perspiration caused by the gloves increases the sensitivity. If conditions arise where neither Gloves nor Ointments are feasible, then a

counteracting application after the working period should be used. All these various possibilities should be analyzed competently in approaching the problem of prevention and choice of creams.

As to metal cleaners and degreasing agents, the protective cream should be insoluble in such cleaners. This is one of the newer developments in Protective Creams, but it is available to a very satisfactory degree.

In general, this is the story in a limited way on skin hazards in the plating industries. I know and you will probably admit, that it is nowhere complete. But in order to complete it, it would tax your patience and time beyond reason. Industrial Skin Diseases are subject to a great deal of controversy, but the most important point is the great expense involved in taking care of such cases, and not the number of fatalities involved.

I could give you any number of statistics to substantiate the facts that Skin Diseases constitute almost two thirds of the compensated occupational Diseases Claims. That lost time cases cost an average of $70.00 each, for compensation, and over $100.00 each in Medical Costs.

The State of Ohio recently published figures that show 8500 cases of skin-disease Claims out of a total of 10800 over a specific period of time. But, if properly analyzed, these are only the lost time cases. It is not known how many additional cases are given first-aid and Medical attention without even being reported to Industrial Boards. We can easily hazard a guess that as many more skin cases go unreported as are on the record. This assumption is based on our experience with Large Factories whose potential number of cases are very large, and whose Medical Staffs are among the most Modern and Complete in the Country.

There is much more evidence along the same lines, but it is not necessary to quote it, because with the advent of Occupational Disease Legislation, Skin Diseases today are recognized Hazards. That this is true is borne out by the fact that six years ago, only nine States included Occupational Diseases in their Compensation Acts as compensable. Today there are twenty-four, and they all include skin Diseases, either as a blanket coverage, or specific Schedules.

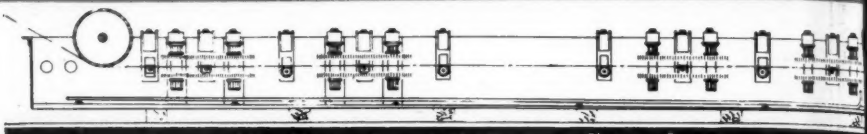


Diagram of Strip Cleaning Apparatus for Continuous Cleaning Operations

FOR EVERY CLEANER NEED!

There's a *Matawan Cleaner* for the entire range of cleaning requirements — from the simplest to the most complicated needs. Many have been leaders for years, and all are manufactured as principal products from ingredients specified by our experienced engineers and continuously check-tested by our chemists.

Matawan Cleaners must be, and are, uniform and uniformly good. Their merit is proven by what they do under actual operating conditions in the plant. When you buy *Matawan Cleaners* you purchase from a firm which engineers and builds cleaning equipment for every type of job from simple tanks to complicated machines for cleaning strip steel and wire — and has had a broad background of experience in all types of cleaning operations.

Since good cleaning is essential to good plating, a proper cleaner selection is primarily important for best results. To make the proper cleaner selection for the work to be done, or to find out why your present cleaner may not be working satisfactorily, call in our engineers and chemists who will assist you — without obligation.

Our responsibility does not end with Cleaner *sales*, but only when a good cleaning job has been done for you. For best results use *Matawan Cleaners*. Write for complete data.

Diagram of Simple Cleaning Tank showing top and side elevations

For over 120 years, good serv
satisfied customers have form
keystone of the growth of ou
ness. But today, due to the
of certain materials, defense
and priority demands, we
able to meet promptly the n
some of our customers who,
past, have helped build ou
ness, and upon whom we m
pend for our future success.

In addition to enlarging our
and adding to production
ment, we have increased our
Engineering and Research
and even though we may
able to supply you now,
value your goodwill and wish
operate to every possible ex
suggesting ways to change,
place current plating, pol
cleaning and pickling meth
til the present unavoidab
ditions return to normal.

Manufacturers of a complete line of electroplating and polishing equipment and supplies

HANSON-VAN WINKLE-MUNNING CO.

MATAWAN, NEW JERSEY

NEW ANODE SAVER BASKET

In the present shortage of metals, efficient use of anode scrap is vitally important and the new H-VW-M Anode Saver Basket has been especially developed for this purpose.

A single new anode rod in this basket, surrounded by anode scraps, permits good plating results with left-over anode pieces. Basket is ruggedly constructed of steel mesh wire, reinforced at top, ends and bottom and welded to the frame. Entire basket is rubber covered. Can be used in solutions under 190°F. temperature (most plating solutions are under this).

Baskets come in four standard sizes, all 4″ wide with 4″ or 5″ hooks, 9″ long x 18″ deep; 12″ x 24″; 16″ x 30″; 20″ x 40″. All dimensions are inside measurements.

H-VW-M WOOD TANKS

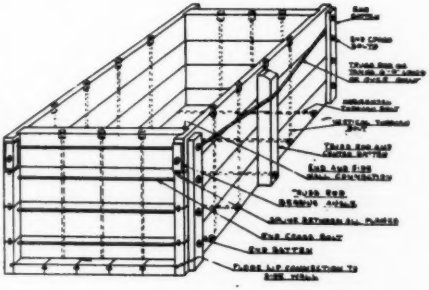
other item in demand because of metal shortage — H-VW-M Wood nks. We can furnish them unlined for hot and cold rinse treatments; haltum lined principally for acid solutions such as nickel, copper phate and zinc sulphate baths; lead lined for same type of solutions used in asphaltum lined except heated baths y be used.

H-VW-M Wood Tanks are made of best qual- kiln dried cypress or redwood with oak rein- ing battens at end. Lumber is grooved, d together and supported by rods — 2″ nber for tanks up to 6 feet long; 3″ stock for ks up to 20 feet long. Wrought iron bolts and rods with iron washers and nuts are standard.

haltum used for lining is a special grade not cted by plating solutions when temperature s not exceed 90 F.

d for lining is ⅛″ thick but $\frac{3}{16}$″ or ¼″ thick be supplied if desired. All seams on lead d tanks are burned in.

mpt shipment of Wood Tanks can be made



PLANTS: . . Matawan, New Jersey . . Anderson, Indiana . . Bridgeport, Connecticut

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Business and Social News

BRANCH NEWS

Educational Activities

AMERICAN ELECTROPLATERS' SOCIETY

Bridgeport Branch held a picnic and meeting at Mr. Boggild's home Saturday, July 26, 1941, at 2:00 P.M. in Trumbull, Conn., with 30 members and friends participating. We had a fine day for this occasion and everyone present enjoyed the affair immensely. There were plenty of refreshments and everyone participated in card playing, horseshoe pitching and other sports. Joe Sterling took first prize in horseshoe pitching in a playoff with Dr. Walter Meyer. We thank Fred Gotthardt, Axel Boggild and the Committee for making this picnic a success. Clarence Helmle did honors as an instructor in croquet playing with the able assistance of Ralph McCahan. Needless to mention, we had a very good time. Bill Nickerson of the Magnesium Products certainly has shown ability as a chef with his "*It's ready–come and get it.*"

The meeting was opened at 7:00 P. M. with Secretary Joe Sterling presiding. Prescott C. Albee of the Jackson Buff Corp., Long Island, applied for associate membership. Paul B. Krouse, W. E. Krouse & Company was elected as an associate member.

A motion was made and passed that the September Outing is to be held at the home of Mr. William Ehrencrona in Trumbull with tickets at $1.50 per person. The Committee for this affair is William Ehrencrona, Chairman; Eugene Phillips; William Flaherty; George Wagstaff; Herman Braun; Fred Gottchardt.

Charles Auburn sends in resignation due to inability to participate in meetings and other activities of the Society and has other responsibilities. Motion was made and passed that David W. Dick, being in the service of our Country, the dues shall be temporarily dispensed with.

JOSEPH G. STERLING, *Secy.*

Chicago Branch regular monthly meeting was held on August 9 at the Atlantic Hotel. Mr. K. D. Overholt and R. E. Olson were elected as associate members. Mr. Frank Rushton of Los Angeles Branch was in Chicago for a short visit with his many friends who were very pleased to see him.

Several members spoke on the various ways of plating chrome to save on nickel and other metals that might be used in place of nickel. This round table discussion brought out many fine suggestions and gave us all something to think about and should be continued at future meetings.

Mr. E. Woodmansee, the librarian, found the following questions in the question box.

1. *What can be used in place of Aluminum baskets for bright dipping small brass parts?*

Ans. Nichrome or Stainless steel baskets, stone crocks, or you might try Monel metal covered with vitreous enamel.

2. *What causes the copper anodes to flake off in a Rochelle copper solution?*

Ans. It was thought the anodes should be checked for impurities such as silver or arsenic.

J. W. HANLON, *Secy.*

DON'T FORGET THE DETAILS

When ordering plating tank equipment, your specification should protect the quality of all needed accessories.

The key to perfect plating is expert execution of every feature of these complex constructions. The tank illustrated is not exceptional in the routine of Storts production. Experienced craftsmen fashion the piping, the exhaust casings, the linings, the coils, the anodes, and install the fittings. There is no weak link in the chain of operations that produce this assembly and deliver it with its sleeves rolled up — ready for work.

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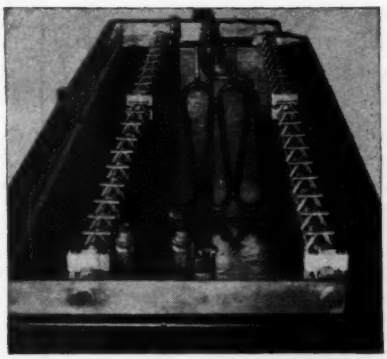

STORTS WELDING COMPANY

42 Stone Street **Meriden, Conn.**

Manufacturers of Welded Fabrications to Specification

Newark Branch held its first regular meeting at their new meeting quarters at the Hotel Robert Treat, Newark, N. J., on Friday evening July 18, 1941. The meeting was called to order at 8:30 P.M. by Vice-President William Bruhns.

A communication from the management of the Hotel Robert Treat was read and placed on file. Communications from Mr. Fred C. Gross and Mr. John J. D'Elia submitting their resignations were read and it was voted that their requests be granted with regrets. The Secretary was instructed to notify them to this effect. An application for Mr. Klaas of Divine Brothers Co. was voted to take the regular course.

Mr. Smith, Mr. Wagner, and Mr. Oldam made a detailed report on the Convention. The Secretary stated that he had received a phone call from Mr. Donroe, Librarian, stating that he would be unable to attend the meeting but wished to inform the members that the original plan for the contemplated program was well on the way and that all letters to the members would be mailed within the next few days.

Mr. George Reuter conducted a question box. Some of the questions were as follows:

1. *What is the best method for removing oxide scale from old silver plated ware?*

Ans. Soak in pure muriatic or hot muriatic pickle until scale is dissolved then scratch brush. Repeat the operation if scale is not all dissolved.

EXPERIENCED ELECTROPLATERS
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... because their unexcelled purity assures uniform corrosion, the highest quality deposit in the shortest possible time and low scrap losses. Furnished with suspension holes drilled as desired, or tapped for end hooks.

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Never any black streaks.
Extremely high throwing power.
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143 Exchange Street
WORCESTER, MASS.

2. *Which tin solution operates the best 24 oz. Stannate per gallon or 12 oz. Stannate per gal. in a still plating solution?*

Ans. No one is operating a 24 oz. solution. Majority have very good results with the 12 oz. solution.

3. *How can you prevent a zinc deposit on a spot welded assembled chassis from staining around the seams?*

Ans. Rinse in hot and cold water; submerge in a soap solution; and dry with hot air.

GEORGE WAGNER, *Secy.*

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Herbert Hawkins

It is with regret that I have to state that on July 17, 1941, Herbert J. Hawkins of Detroit, Michigan passed on and was buried in Woodlawn Cemetery. Mr. Hawkins was an Honorary Member of Detroit Branch A.E.S. He was also one of the three men who were most active in organizing Detroit Branch. He was a resident of Detroit since 1909; before that he had lived in Chicago Ill. He was very active in the plating industry; and about 1900 he wrote a book and had it published on Polishing and Plating of Metals. His book was called, "Herbert J. Hawkins on Plating," during that time considered one of the best published on the subject. For years it was a guide to most of the platers of that time and up to 1920 or 21 when Blum & Hogaboom's book came to be published.

Mr. Hawkins had retired from active service of the plating industry and had settled on a fruit farm in Michigan about 1905. But it was very hard for one who had been so active to retire. The Dow Company of Mansfield, Ohio persuaded him to become a salesman and troubleshooter. He was with the Dow Company a couple of years.

Then with the Hanson Van Winkle Company in 1909 he became Detroit manager for that company. He made his home in that city and managed the business for the Hanson Van Winkle Company very successfully. He was well liked by all with whom he came in contact. He became interested in Christian Science about that time (1909) and later became first reader of First Church of Christ Scientist of Detroit. During his term as reader he retired from the activities of the plating industry, and devoted the remainder of his days and nights to the practice of Christian Science. He was a successful practitioner.

He was a true friend, always ready to help anyone in need of help. His many friends will miss him. The A.E.S. has lost one of its members. And personally I am glad to have known him as one of my best friends.

The A.E.S. members wish to extend their sympathy to the family of Mr. Hawkins in the loss of a loyal and distinguished member.

T. C. EICHSTAEDT

MAGNUSON PRODUCTS CORPORATION EXPANDS

The Magnuson Products Corporation announce the removal of their main offices, from the plant at Hoyt and Third Streets, Brooklyn, N. Y., to 50 Court Street in the Terminal Building. Mr. Edward Magnuson, president of the corporation, states that this change has become necessary owing to the steady expansion of the business, which now requires more room for manufacturing and future development of PERMAG Cleaning Compounds. The Magnuson Products Corporation was established by Mr. Magnuson in 1923 in Brooklyn; and the growth of the concern has been constant and successful; the enlargement of their plant is an outcome of sound and constructive management combined with the production of a high class dependable product which is in wide demand.

MEMBERSHIP CAMPAIGN RULES

1. All Branches of the Society at the beginning of the fiscal year are eligible.
2. Membership shall be based on the correct list of the Executive Secretary at the beginning of the fiscal year. Any corrections in the 1941-1942 membership lists must be made by October 1, 1941.
3. A monthly report of the progress of the campaign shall be made to the membership chairman of each branch each month and shall appear in the MONTHLY REVIEW.
4. Monthly progress reports shall be based on the branch reports mailed to the Executive Secretary not later than the first day of each month.
5. Changes in membership shall be calculated as percentage changes based on membership at the beginning of the fiscal year.

MAURICE R. CALDWELL
resident of Grand Rapids Branch and Third Vice-President of the National Society

6. Changes in membership by elections, suspensions, resignations, reinstatement, and death shall be given full credit. Changes in membership by transfers shall be given half credit.
7. An award to be known as the A.E.S. Membership Trophy will be awarded to the branch securing the greatest percentage increase in membership for the fiscal year.
8. A trophy is to be awarded each year. This trophy will be held by the winner as a permanent possession. A Branch may win the trophy more than one year, and will be awarded a new trophy for each successful year.
9. The Branch Secretary shall be responsible for the trophy.
10. The trophy shall be presented to the winning branch at the first business session of the Convention.

MAURICE CALDWELL,
Chairman Membership Committee

Here and There

The annual outing of the Detroit Branch was held on Saturday, July 26 at Sandy Mac's. Despite the intense heat there was a good attendance of platers, peddlers, and others. The able and energetic George Nankervis was chairman, assisted by the new secretary of the branch, Warren I. Grimmer, who handled the tickets and acted as a sort of Bureau of Information. Several members of the branch had charge of the sports which consisted of golf, horseshoes, etc. There were also exhibition boxing and wrestling bouts that kept the crowd happy after the dinner, which was served between 1 and 3. Free drinks of all kinds were quite popular inasmuch as the temperature was around the century mark. Before the party "broke up" a number of prizes were distributed to lucky ticket holders, one of these being a beautiful radio set.

We wish it were possible for us to chronicle all the details of the outing. We did not have much time to spare, however, as we were busy discussing A.E.S. affairs with some of the leading members of the branch. We noticed that these midsummer outings are becoming more and more popular, many of our Canadian friends coming over to enjoy the good fellowship and other things that help to make these parties so successful. In the course of the conversation, A. B. Wilson made the interesting remark that Mr. Cameron, the well-known radio speaker on the Ford hour will give one of the addresses at the annual meeting of Detroit Branch in December. Another well-known speaker, possibly an OPM representative will also be invited.

Ted Eichstaedt has given us a brief outline of the life of Mr. H. Hawkins, an Honorary Member of Detroit Branch, and author of the popular book on electroplating which held its popularity for a great many years. Mr. Hawkins's recent death called forth many expressions of regret amongst the older members of the Society, some of whom were his personal acquaintances.

We wish to thank the members of the branch for their kindness and hospitality during our stay, particularly W. W. McCord who so kindly looks after our welfare during these periodic visits and furnishes the transportation, which is a very important item as we travel from branch to branch in an endeavor to gain and give information relative to the Society's welfare.

After leaving Detroit we journeyed to Grand Rapids, where we met the Convention Committee, including Maurice Caldwell, third Vice-President of the National Society and president of Grand Rapids Branch, and Chester Smith, general chairman of the 1942 Convention Committee. Mr. Smith, Monte Pace, and the Executive Secretary spent the afternoon at the Pantlind Hotel, Convention headquarters, discussing many things regarding the 1942 convention. Mr. Pace is publicity chairman and chairman of the program committee and has many novel ideas concerning next year's meeting, all of which are sane and sound. Mr. Lyman Sperry, assisted by Mr. Caldwell, has already started to solicit papers for the Educational sessions. Mr. Smith also has a few new wrinkles which are very interesting. One of these is the use of photography in connection with plating exhibits.

The meeting on Monday night, at which time most of the Committee Chairmen were present (some were on vacation) was a question and answer period and lasted until nearly midnight. Mr. Edward J. Brunette of the Convention Bureau was invited to attend the meeting and gave some valuable suggestions. Mr. Brunette's helpful cooperation is much appreciated by the Convention Committee.

We believe the chairmen of the different committees are fully alive to their responsibilities. All they need to make next year's convention successful is the assistance of the members of the various branches of the A.E.S. Representing the Society in an official capacity, we assured the members of the entertaining Grand Rapids branch that the loyalty and cooperation of our

members has never failed yet. We bespeak for them your loyal support.

We wish to thank Mr. Caldwell for the privilege of visiting the plant of the W. B. Jarvis Co., manufacturers of automobile parts, of which he is foreman in charge. Considering the volume of work being plated each day, we wonder why men like Mr. Caldwell add to their problems the details of a National Convention. We know from experience, with other conventions, however, that if you want a job done well, ask a busy man to do it. That's the spirit in which the Grand Rapids members are laying the foundation for a most successful annual meeting at Grand Rapids in 1942.

ARE WE TO HAVE A BRANCH OF THE A.E.S. IN ST. PAUL

Recently there has been a desire on the part of some platers to start a branch of the A.E.S. in St. Paul, Minnesota. We had planned to visit St. Paul during our visit to Detroit and Grand Rapids, but found that it was too early in the year to get results. We hope to visit Chicago in the fall. At this time we would appreciate the cooperation of all concerned in making the necessary contacts regarding St. Paul. We particularly ask the assistance of Milwaukee branch members in this connection.

PAPERS FOR THE REVIEW

We are in need of papers for publication in the REVIEW each month. We commend the Secretary of Los Angeles Branch, Mr. Ervin Frauenhoff for sending us the excellent papers read at the branch meetings. We are asking the secretaries of other branches to do likewise. Our September issue will contain a fully illustrated article by F. A. Maurer, Engineer of Processes, General Electric Co., Ontario, Cal., entitled "Cleaning and Bright Plating Iron and Steel Parts of Electric Irons."

CHLORINE PUT UNDER FULL PRIORITY CONTROL TO ASSURE SUPPLY FOR POWDER, OTHER USES

Chlorine was placed under full priority control July 28 in a general preference order signed by Priorities Director Stettinius. The order requires that defense orders for this important chemical be filled ahead of nondefense contracts and also stipulates that producers must accept defense orders in preference to all nondefense calls. For the present, it is not expected that the volume of defense orders will be greatly increased. Meanwhile, manufacturers are free to make other deliveries if they have sufficient capacity to do so after meeting defense orders.

All defense orders which do not bear a higher preference rating are assigned a rating of A-10, thus placing them ahead of orders bearing lower ratings or no ratings.

Principal military uses for chlorine are in bleaching cotton linters for smokeless powder, and in the chemical warfare area, including the production of gases and smoke-screen materials.

Principal civilian uses, in the chemical industry, are for bleaching paper, for the production of dry-cleaning materials, anti-freeze compounds, and premium gasolines. About 25 percent of the production has been used recently for bleaching paper, and this use is now being restricted voluntarily by the industry.

Cut Will Affect Color of Paper

In general, chlorine is not essential for the *production* of paper, but it is necessary for the *bleaching* of the paper produced. It is expected that certain paper products will be more affected than others. Restrictions in the amount of chlorine for bleaching will affect the coloring of writing papers, gloss and other papers for magazines, and high grade paper for books.

Newsprint will be unaffected.

The first horizontal cut of 10 percent accepted by the paper industry will result in a difference of approximately 5 percent in paper shadings. Studies are now being made toward further possible reductions.

SPEAKERS AND MOVIES AVAILABLE TO A.E.S. BRANCHES FOR 1941 AND 1942

Sponsor	*Speaker*	*Subject*	*Remarks*
Hanson-VanWinkle-Munning Co.	Geo. B. Hogaboom	Electroplating, Cleaning, etc.	
Hanson-VanWinkle-Munning Co.	Myron B. Diggin	Electroplating, Cleaning, etc.	
Hanson-VanWinkle-Munning Co.	Edgar H. Pollacek	Generators, Rectifiers, etc.	
Hanson-VanWinkle-Munning Co.	M. J. Moll	Automatic Conveyors, etc.	
Hanson-VanWinkle-Munning Co.	Allen T. Baldwin	Hot galvanizing and tinning	
Hanson-VanWinkle-Munning Co.	B. C. Case	Bright Nickel & Copper	
Hanson-VanWinkle-Munning Co.	V. Mattacotti	Bright Nickel, Zinc & Copper	
Divine Bros., Utica, N. Y.	Will furnish speaker on Polishing & Buffing on request		
Detroit Rex Products Co.	W. F. Newbery	Cleaning Equipment	Northeast U. S. A.
Detroit Rex Products Co.	L. Camel	(Illustrated with Movies)	Northern Ohio
Detroit Rex Products Co.	W. H. Hoppenjans		Southern Ohio
Detroit Rex Products Co.	A. E. Willard		Central States
Lucius Pitkin, Inc. 47 Fulton St., N. Y.	Charles Davidoff	Electropolishing	Expenses must be paid
Indiana University Bloomington, Ind.	Dr. F. C. Mathers	Addition Agents	Expenses. Available after first of year – preferably on Saturday night
Alsop Eng. Corp. Milldale, Conn.	R. J. Green	Various phases of filtration and purification	
Oakite Products 22 Thames St., New York	E. C. Rinker	Cleaning & allied operations	
The Electric Products Co. Cleveland, Ohio	G. J. Berry	Motor Generators	
	F. K. Rouge	Motor Generators	
The J. C. Miller Co. Grand Rapids, Mich.	Robt. V. Twyning	Buffing Compounds	Available in Midwest
	Chester W. Smith	Citrate additions to Cyanide Copper Solutions	Available in Midwest
The J. C. Miller Co. Grand Rapids, Mich.	Chester W. Smith	Insoluble Anodes in Nickel Plating	Available in Midwest
Northwest Chemical Co. 6531 Russell St., Detroit	B. F. Lewis	Cleaning & related fields	Probably illustrated with colored slides
McGean Chemical Co., Cleveland	Dr. A. K. Graham	To be announced	
Zapon Brevolite Div. Atlas Powder Co., North Chicago, Ill., and Stamford, Conn.	To be announced	Synthetic resin type finishes	
The Carborundum Co. Niagara Falls, N. Y.	To be announced	Abrasives	A 50 min., 16 mm. sound film is also available
Darco Corporation 60 E. 42nd St., New York	W. A. Helbig	Activated Carbon	East of Mississippi
E. I. duPont de Nemours & Co. Wilmington, Del.		"A New World Thru Chemistry"	This is a Technicolor movie depicting manufacture and

EW
Niagara Falls, N. Y. ..... East of Mississippi .....
Darco Corporation ..... W. A. Helbig ..... Activated Carbon .....
60 E. 42nd St., New York
E. I. duPont de Nemours & Co. ..... "A New World Thru Chemistry" .. This is a Technicolor movie depicting manufacture and
Wilmington, Del.

The Abstract Section

CHARLES C. CONLEY, *Chairman, Program and Educational Committee*

The Theory of the Potential and the Technical Practice of Electrodeposition. By CHARLES KASPER. **I. The General Problem and the Cases of Uniform Flow.** *Trans. Electrochemical Society* **77,** 353-64 (1940). In electroplating, the distribution of current, and hence the uniformity of the plate over the cathode, is governed by mathematical laws which are exact and well-understood, although their application to electroplating has been neglected. Dr. Kasper undertakes to remedy this neglect, and in so doing points out facts of great practical usefulness and importance, which can be of substantial assistance to electroplaters. In this first paper of the series, general considerations are outlined and simple cases discussed and treated mathematically.

As must be the case, for the sound exposition of advanced mathematical treatment, the first illustrations are too simple to be of direct interest to the electroplater, but they are essential to the student who would thoroughly understand the later work.

The results of the mathematical theory represent not approximately, but exactly, the results obtained in practice, provided only that certain simple conditions are fulfilled. The only condition from which practical electroplating may vary widely is that the composition of the electrolyte must be uniform throughout the bath. This condition may be fulfilled by the use of adequate agitation. The results apply very exactly and rigorously to the commercial electroplating problems.

The theory involved is that of the potential, which is of fundamental and widespread application in science and industry, and is the fruit of marvelous work of a large number of celebrated scientists. There is no practical field which so thoroughly involves and illustrates this theory as that of electrodeposition. The riches of this theory are made available to the electroplating industry by this series of papers.

The mathematical development of the theory, and the results, is placed in a separate section, so that the description of the ideas involved and the results and applications of the computations may be understood, with some study, without following the somewhat advanced calculations which are required.

In treating simple cases in this paper, it is shown that the distribution of current and plate becomes more uniform as the anode and cathode are separated, *up to a certain point.* Beyond this point, further separation has no appreciable effect on the distribution. For certain shapes, this critical point may be calculated mathematically.

The elementary cases considered here and in part of the second paper have also been presented in *The Monthly Review A. E. S.* **26,** 11-26, 91-109 (1939); and *Proc. 26th Annual Convention of the American Electroplaters' Society* **1938,** 21-32.

II. Point-Plane and Line-Plane Systems. *Trans. Electrochemical*

Society **77**, 365-84 (1940). The considerations of Paper I are extended to solve slightly more involved problems in current distribution, and clearly illustrate the methods of the theory of the potential. The current distribution is represented graphically for flow from a point to a flat surface, and from a line, such as a straight wire, to flat surfaces. The effect of tank walls and of the surface of the solution is shown, and is of interest to electroplaters.

The theory has been repeatedly verified experimentally for different electrolytic systems, some of which are mentioned, and is now firmly grounded. Further experimental verification, as with models to be presented, though interesting, will serve only to show that the stipulated conditions on which the theory is based actually obtain in practice.

In practical electroplating, the problems are generally too difficult to be handled mathematically, but the theory may clarify the nature of the problem. Experimental study of each case with the objects to be plated and the solutions to be used will always be required, but it can be directed and expedited by the theory, especially by interpreting results obtained with test solutions in which the current variation appears exaggerated.

III. Linear Polarization on Some Line-Plane Systems. *Ibid.* **78** (Preprint 18) (1940). Continuing the theoretical consideration of current flow and distribution in electroplating, the effect of polarizarion is discussed for some of the cases treated in previous papers. Certain practical conclusions are pointed out. It has been shown that "throwing power" is not a definite property of a solution, but depends on the size and form of the electrodes, as well as on the polarization, conductivity, and cathode efficiencies (particularly at low current densities) of the electrolyte. "Throwing power measurements" are of little or no significance. For a given object to be plated, if one solution has a higher polarization, conductivity, and cathode efficiency at the lowest current density, than another bath, it will generally produce more uniform deposits on irregularly shaped objects, or, in the language of the electroplater, have "better throwing power." If polarization, conductivity, and cathode efficiency do not all favor the same solution, it is impossible to say which will give the more uniform deposit, or "throw better," except by actual experiment with the object to be plated.

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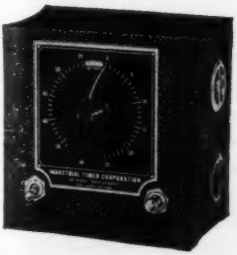

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Because the size and form of the cathode enter in, it is possible that of two solutions, one may have superior "throwing power" for some objects, while the other will excel for other objects. Or it may be that one solution will produce more uniform deposits on certain portions of the article, such as are decorated with fine engraving, while another solution, though producing less uniform deposits on those areas, will yield a more even distribution over other sections or over the object as a whole.

Polarization tends to make the deposit more uniform, but its effect is hardly appreciable except in very small recesses, pits, scratches, and engraved lines. It is more important in its effect in producing a smoother deposit. For recesses of the size usually considered in discussing "throwing power", polarization may be neglected. In most practical cases, and particularly for comparing solutions of differing types, cathode efficiencies at very low current densities are the only important criteria for estimating "throwing power".

Mathematical solutions are given for certain cases of electrodes.

IV. The Flow Between and To Circular Cylinders. *Ibid.* **77** (Preprint 19) (1940). The distribution of current flowing between a row of anodes (corresponding to an infinite plane) and a cylinder, such as a wire, is discussed. It is shown that there is a critical distance between anodes and cylinder, or wire, below which the distribution of current, and hence of deposit, is seriously impaired, while at greater distances this distribution is not much improved. This critical distance is usually about three or four diameters of the cylinder, and the minimum current density, at this spacing, is about 80% that of the maximum current density. For solutions like chrome-plating baths in which

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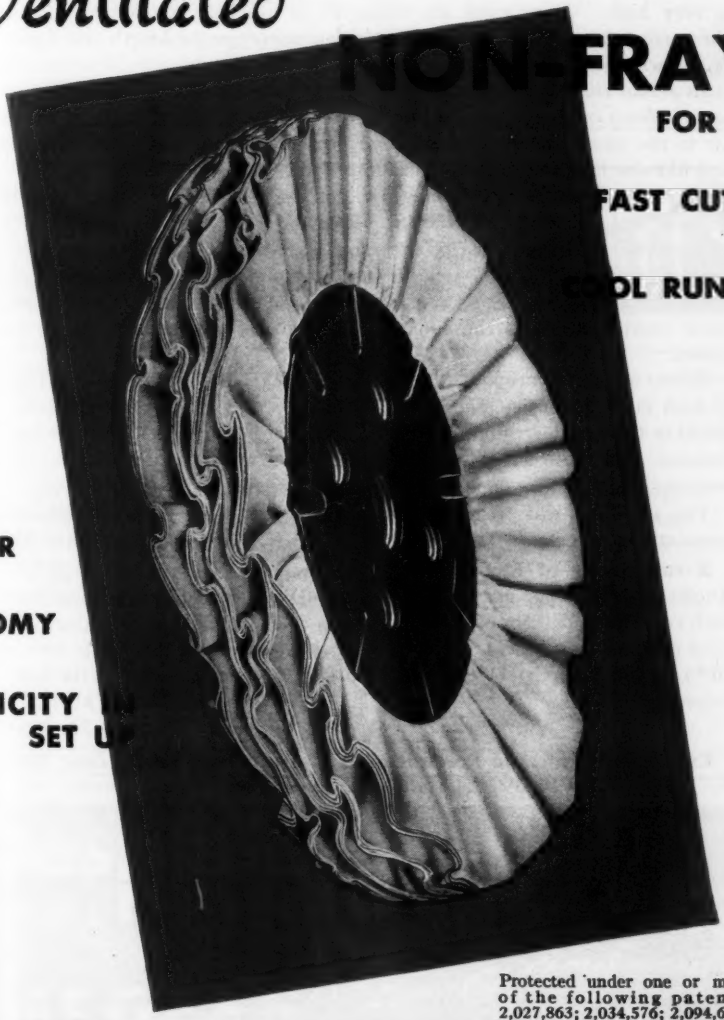

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the current efficiency varies rapidly with the current density, greater distances must be used.

When the cylinder is plated between two rows of anodes, the uniformity is very high. When wires are employed as auxiliary anodes or "thieves," the current drawn from or to a wire is dependent on the length and diameter of the wire.

In actual commercial plating, where there is more than one cathode, interactions from other cathodes affect the current distribution. These are similar to the interactions outlined above for one cylinder and a row of anodes, and likewise indicate that there is another critical distance or spacing between the cathodes. At greater spacing, the current distribution is not much more uniform, but at less spacing, the effect known to the electroplater as "shading" is observed. For cylinders of the same size, this critical distance is about twice the diameter of the cylinders. In practice, the distance to the tank walls and surface of the solution must also be considered. Applications of these considerations to the commercial electrogalvanizing of wire are mentioned.

Where auxiliary cathodes ("thieves") or shields are used to protect regions of high current density, these results indicate that the separation from the shield or thief to the region to be protected must be small, or below the critical distance, and the exact position within this separation is important. These concepts are to be developed in a forthcoming paper.

The mathematical treatments of these cases, with and without linear polarization, is given. ERNEST H. LYONS, JR.

X-ray Study of Electrolytic Deposits. II. Zinc. By A. RUBIO. *Anales soc. espan. fis. quim.* **36,** 76-90 (1940). Electrodeposited zinc from a bath containing Zn0 50, KCN 160, Na_2SO_4 50, cryst. $NiSO_4$ 1, licorice 10 g./1. were examined by x-rays. The particle size of the zinc deposit is less than 10^{-6} cm. and the axis (1120) is oriented in a direction parallel to the lines of current. E. M. SYMMES

Chemical Abstracts **34,** 7182

Experiments for the Precipitation of Iron from Large Zinc Baths. By S. V. LITVINOVICH. *Proizvodstvenno-Tekh. Byull. Zavoda im. S. Ordzhonikidze* **1939,** 24; *Khim. Referat. Zhur.* **1939,** No. 11, 88; *Chemical Abstracts* **34,** 7182. Iron is removed by adding 1-2 g./1. of potassium or

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ammonium persulfate for each 0.4 g./1. iron in the bath, then neutralizing the bath with sodium carbonate or zinc oxide, and filtering or decanting off the iron precipitate. ERNEST H. LYONS, JR.

Standard Methods of Controlling the Thickness of Nickel Plate. By D. S. ABRAMSON. *Zarodskaya lab.* **9,** 534-9 (1940); *Chemical Abstracts* **34,** 7182. A solution of ferric chloride, copper sulfate and acetic acid may be employed in a jet test for determining the thickness of nickel plate; the error is 17-18%. With freshly deposited coatings the jet test may be replaced by a dropping test. ERNEST H. LYONS, JR.

Electrolytic Removal of Scale. By A. I. LEVIN. *Avtotraktornoe Delo* **1939** No. 2-3, *Chemical Abstracts* **34,** 7183. A description of the Bullard-Dunn Process: electro-pickling with work cathodic and a little lead in the bath, which is removed by anodic treatment in an alkaline solution.
ERNEST H. LYONS, JR.

Thickness of Nickel Plating on Brassware. By E. ARMSTRONG. *Metal Treatment* **5,** 127-30 (1939); *Chemical Abstracts* **34,** 7183. Nickel plate on brass, unlike that on steel, is very effectively preserved by a thin flash of chromium, far more than by a heavy coating of nickel alone; and the nickel need not be heavy for good protection of the brass, if the plate is sound. The minimum thicknesses suggested are 0.0001" Ni and 0.000005 Cr. (Note: If this can be verified, it should be of value under the present scarcity of nickel.)
ERNEST H. LYONS, JR.

Iron Electrotypes. By S. I. PLATACH. *Poligraf. Proizvostvo* **1940,** No. 4, 32-4; *Chemical Abstracts* **34,** 7183. Recommended conditions for electrodeposition of iron: $FeSO_4$ 380-390, NaCl 190-170 g./1., pH 2.2, 100-104°C. (212-220°F.), current density 8-12 amps./sq. dm. (74-111 amps./sq. ft.), 2.5-4 v., ratio anode to cathode area ¼ to ½. ERNEST H. LYONS, JR.

The Electrolytic Manufacture of Tinplate Strip. By C. C. DOWNIE. *Sheet Metal Ind.* **14,** 29-30 (1940); *Chemical Abstracts* **34,** 6883. After a hot pickle, the strip is scrubbed with revolving brushes of corrosion-resisting steel wire, and then passes into the tin plating bath. After plating, the strip is polished and coiled. The bath contains $SnCl_4$ 4, NaOH 16, $Na_2S_2O_3$ 8, and NaCH 2 oz./gal. The thickness of plate is controlled by varying the current densities. No details are given. ERNEST H. LYONS, JR.

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In the Air. By P. B. RASTELLO. *Safety Eng.* **79,** No. 3, 35-6, 38 (1940). Precautions to be used against fumes and vapors from electroplating are described.

ANN NICHOLSON HIRD

Chemical Abstracts **34,** 7755

Cathodic Degreasing of Iron Surfaces. By E. YA. GOL'DENSHTEIN and B. L. AGRANAT. *Byull. Malyarnoi Tekh.* **1939,** No. 4, 32-5; *Khim. Referat, Zhur.* **1939,** No. 10, 118-19; *Chemical Abstracts* **34,** 7753. Best conditions for removing petrolatum and castor oil from iron cathodically are 53 g./1. NaOH, 30 g./1. $Na3PO_4$, (7 and 4 oz./gal.), 6 amp. sq. dm. (56 amp./sq. ft.), 80-90° C. (176-194° F.), 2.5 min. Without current, 30 minutes are required.

ERNEST H. LYONS, JR.

The Distribution of Potential in the Electrodeposition of Zinc. By A. I. LEVIN and O. A. ESIN. *J. Applied Chem.* (U.S.S.R.) **13,** 38-44 (in French, 44) (1940). At an average potential of 3.4 volts, about 85% of it is electrode potential, 13% is required to overcome the resistance of the electrolyte, and 2% to overcome resistance of the contacts.

A. A. PODGORNY

Chemical Abstracts **34,** 7753

Development of the American Process for the Tin Plating of Wire. By R. HARBISON. *Draht-Welt* **31,** 685-7 (1938); *Chem. Zentr.* **1939, I,** 1643. In place of tinning with the molten metal, the tin coating is deposited electrolytically from an alkaline bath. The electrolyte contains per liter: 75 g. $Sn(ONa)_4$, 12.5 g. NaAc, 7 g. NaOH, and 2 g. H_2O_2. The bath temperature is 65-70° C., the voltage 4-6 v., and the anodic current density not more than 2 amp./sq. dm. Besides tin anodes, 10% steel anodes are used. The advantages of the process are a lustrous white coating without the addition of colloids to the electrolyte, no spongy deposits, high throwing power and the use of high current densities.

M. G. MOORE

Chemical Abstracts **34,** 7754

Bright Zinc Coating of Steel and Brass Parts in Cyanide Baths. By L. S. MKHITAR'YOU. *Aviapromyshlennost* **1938,** No. 11, 29-32; *J. Inst. Metals* **66,** Pt. 2, *Met. Abstracts* **7,** 74; *Chemical Abstracts* **34,** 7754. Bright zinc deposits are obtained from the bath: ZnO, 5 oz./gal.; NaCN 10.5 oz./gal.; NaOH 10 oz./gal.; and glycerine, 0.4-0.7 oz./gal.; after plating at 19-38 amp./sq. ft. and 68-77° F., the parts are given a bright dip in 3-6% HNO_3.

ERNEST H. LYONS, JR.

The Effect of Foreign Metallic Ions in the Electrolyte on the Inner Structure of Electrolytic Metals. By H. HIRATA, H. KOTO, and M. HARA. *Nippon Kinzoku Gakkai-Si* **3,** 460-9 (1939); *Rev. Phys. Chem. Japan* **14,** 46-7; *Chemical Abstracts* **34,** 7755. X-ray examination showed

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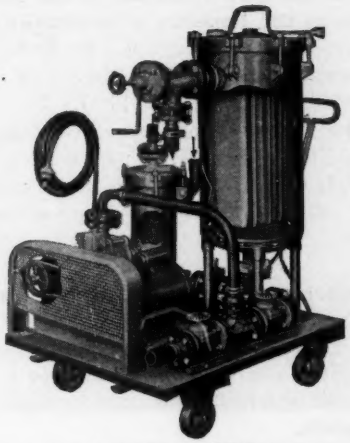

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that ferrous and managanous ions in stannous solutions are not deposited. Cupric ions in stannic solutions and nickel and silver solutions are deposited as colloids outside the microcrystals of the pure tin or silver; zinc in cupric solutions deposits as a brass. The direction of maximum growth and geometrical properties of the crystals were affected.

ERNEST H. LYONS, JR.

The Cathode Processes in the Electrolysis of Solutions of Copper Salts in the Presence of Selenium Dioxide. By V. V. KUZNETSOV. *J. Applied Chem.* (U.S.S.R.) **13,** 45-50 (1940); *Chemical Abstracts* **34,** 7455. Selenium dioxide, SeO_2 (0.05-0.15 mg./1.) is a good addition agent in acid copper baths. ERNEST H. LYONS, JR.

The Use of Other Protective Coatings in Place of Nickel Plating. By EUGEN WERNER. *Werkstatt u. Betreit* **72,** 2-7 (1939); *Chem. Zentr.* **1939, I,** 3452. Of the various metallic coatings, zinc is chiefly to be considered as a substitute for nickel. The various methods of nickel plating are described. M. G. MOORE

Chemical Abstracts **34,** 7754

Polarization in the Cathodic Precipitation of Bismuth. By O. ESIN, M. LOSHKAREV, Z. LEVITINA, and K. RUSAIVOVA. *J. Applied Chem.* (U.S.S.R.) **13,** 56-65 (1940); *Chemical Abstracts* **34,** 7754. In chloride and nitric acid solutions polarization is due mostly to concentration effects and can be largely eliminated by vigorous agitation. Further observations are given. ERNEST H. LYONS, JR.

Production of Manganese by Electrolysis of its Salts. By R. I. AGLADZE. *Mettalurg.* **14,** No. 9, 15-33 (1939). The addition of 10 g. ammonia per liter to managnous sulfate or chloride solutions increased the purity and physical properties of the manganese deposit, helped to maintain constant pH, and retarded the formation of manganous hydroxide on the cathode. The product contained up to 99.98% Mn. For best results the concentration of manganese in the solution was 25 g./1., temp. 10-30° C., c.d. 7.5-25 amp. per sq. dm., and the pH of the electroylte 2-8 for sulfate solutions and 1-7.5 for chloride solutions. H. W. RATHMANN

Chemical Abstracts **34,** 7756

The Anodic Polishing of Electroplated Nickel. By A. W. HOTHERSALL and R. A. F. HAMMOND. *J. Electrodepositors' Tech. Soc.*; Vol. 16, 1940; pp. 83-98. By the anodic polishing of dull electroplated Ni in an electrolyte of H_2SO_4, a surface can be obtained having as high a reflectivity as mechanically polished Ni. This process may be an alternative to bright Ni plating and can be used to produce matt designs by protecting part of the surface. The conditions are not critical. The electrolyte consists of 73% H_2SO_4 by weight (600 ml. conc. acid + 400 ml. H_2O), although a conc. as low as 60% can be used. The satisfactory temperature range is 20-40° C. (60-104° F.) and the current density should be 150 to 300 amp./ft^2. Lower current densities may cause pitting. At temperatures below 20° C. (68° F.) a high voltage is required, and Ni salts may crystallize out on the anode. The time of treatment varies from 0.5 to 2.5 min., depending upon the conditions of deposition and the thickness of deposit. Best results are obtained with

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fine grained Ni deposits and with Ni deposited on well polished base metals. The amount of metal removed is between 0.00005 and 0.0002 in. The chief difficulties encountered are streaking and pitting. Gentle agitation of the specimen helps to avoid these difficulties. Streaking may be prevented without recourse to agitation by adding 0.2 gal. of glyceral or 0.5 oz. of benzene sulphonic acid to one gal. of 73% H_2SO_4. Occasionally the brilliance of the anodically polished Ni is marred by a bloom or fog, the cause of which is not known, but it may be related to the crystal structure of the Ni deposit. The porosity of Ni coatings 0.001 in. thick is not appreciably increased by anodic polishing, but the porosity of coatings 0.0005 in. may be considerably increased. The polishing treatment removes metal more uniformly than it is plated. This is a disadvantage, as it tends to remove too large a proportion of Ni from recesses where the coating is usually the thinnest. A. BRENNER

B.N.F. Jet Test for Determining the Thickness of Silver Coatings. By R. A. F. HAMMOND (Research Dept., Woolwich, England). *J. Electrodepositors' Tech. Soc.*, Vol. 16, 1940; pp. 69-82. The jet test involves allowing a fine stream of a reagent to impinge upon a coating until it is penetrated. The thickesss of the coating is obtained from the time required for penetration. Previously, this test has been applied to the testing of Ni, Cu, Zn and Cd coatings. The reagent used for testing Ag coatings contains 250 g. of KI and 7.44 g. of iodine per liter. The rate of penetration of Ag coatings varies about 2% per degree C. At 25° C., 0.0001 in. of Ag is penetrated in 5.6 sec. and at 18° in 6.6 sec. The endpoint consists in the appearance of a bright crescent shaped area of exposed basis metal. Surfaces which have been amalgamated before plating give a black spot at the endpoint. The rate of penetration of the coating depends on both the KI and iodine conc. of the reagent. The rate falls off rapidly as the KI conc. falls below 250 g./1. The results of the test are correct within about 10%. A. BRENNER

Coloring of Zinc and Aluminum. (A review of German Patent literature.) By HUGO KRAUSE. *Metal Industry* (London), Vol. 57, Aug. 16, 1940; pp. 122-123. Colors can be produced on Zn and Al by dipping in a solution of ammonium molybdate (10-20 g./1. or 0.13-0.27 oz./gal.) at room temperature. Zinc at first becomes iridescent and after 15 min. turns dark brown. If the solution is heated, a black color is obtained in a few minutes. The colors obtained on Al vary from grey to brown. The effect of adding various salts to the molybdate solution is discussed. Colors are stable indoors, but require a lacquer coating for out-of-door exposure. A. BRENNER

Anodic Oxidation of Zinc and its Alloys. By HELLMUT FISCHER and NICKOLAI BUDILOFF. *Metal Industry*, (London), Vol. 57, Sept. 20, 1940; pp. 222-25. The corrosion resistance of films on zinc was determined by immersion in 3% sodium chloride solution containing 0.1% of hydrogen peroxide. The "Cronak" chromate dipping process and the process of J. Schulein, which uses alternating current in a chromate electrolyte are known to be fairly satisfactory. Coatings obtained by anodizing Zn in solutions of stannates, oxalates, permanganates, ferro-cyanides and in sodium hydroxide were not protective. Superior results were said to be obtained by anodizing Zn in a chromate electrolyte containing an addition agent (the composition

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of which was not disclosed). The films thus produced were capable of taking up oils and dyes. A. BRENNER

Barrel Finishing of Metal Products. (Barrel Procedure for Stainless Steel) By H. LEROY BEAVER *Product Finishing* Oct., 1940; pp. 70-76. Article describes general procedure for barrel finishing of stainless steels, generally done in 2 steps, cutting down in unlined steel barrel 27" x 11" of high and narrow type and "color" operation in steel barrel with hard maple liners. For cutting down operation use 3 parts balls to 1 part work, 8 gallons of water and 10 lbs. of emery flour. Barrel operated at 15 R.P.M. for 8 hours. Barrel for coloring was loaded with same amount of work and shot plus 10 lbs. of 6000 grain aloxite or Matchless White Diamond Dry powder XXX. Stainless steels do not respond as well to barrel operations as ordinary steels, hence large loads of burnishing materials will help. Author states that orange peel on stainless is difficult to remove in barrel and should be avoided by specifying correct grain size before fabricating. Ball burnishing with soap in zero hardness water will increase luster. PHIL J. RITZENTHALER

Modern Gold Plating. By J. B. KUSHNER. *Products Finishing*, Oct., 1940, pp. 78-87. Part II discusses various methods of gold coating. Simplest is the dip or immersion gilding. Article must be brass or copper or copper plated. Gold cyanide solutions are used at 150° to 180°F. and work dipped into bath. A very thin layer of gold is deposited by replacement, which is very dense and quite protective in spite of thinness.

Second method is "salt water gilding" where the work is suspended in a porous cup containing gold solution, which cup is contained within a copper tank filled with salt solution and containing a zinc plate. Zinc plate is connected by a copper wire to the piece being plated and electrolytic cell set up between zinc and work will plate out gold at very low current density. Work gets even color and is very uniform in thickness. Several formulas are given. PHIL J. RITZENTHALER

Barrel Finishing of Metal Products. (Factors to Be Considered in Unloading Burnishing Barrels.) H. LEROY BEAVER. *Product Finishing*, Nov. 1940, pp. 30-38. Describes unloading tray arrangements for burnishing barrels. This includes a galvanized bottom box with a floor drain, on top of which is a screen tray to retain work and allow balls to fall through. Other devices shown are a canvas tube over the barrel opening to prevent splashing during unloading. A similar device with a sliding gate also can be used. PHIL J. RITZENTHALER

Pretreatment for Sound Enamel Finishes on Zinc Alloy Die Castings. By E. E. HALLS, *Product Finishing*, Nov., 1940, 52-61. Article is an excellent account of exhaustive tests done on various methods of finishing zinc castings. Castings were treated by the phosphate and chromate solutions and also a series run with no pretreatment. Castings were tested in humidity, salt spray and in outdoor exposure. In all cases, the phosphate and chromate treated castings were best, and bond failure, with flaking, occurred on untreated castings, even with baked primers. Chromate treatment was somewhat better than phosphate, but phosphate was easier to use in shop. PHIL J. RITZENTHALER

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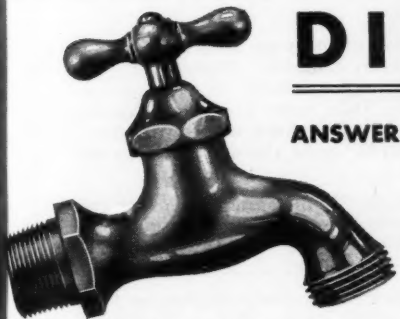

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Barrel Finishing of Metal Products. By H. LEROY BEAVER. *Product Finishing*, Jan., 1941, pp. 30-34. Abrasion and impingement in barrel finishing. Abrasion is described as "wearing off" or rubbing down by a process of wear. Impingement is an impact of short duration between two bodies, and involves a definite energy change. The latter process should be avoided as it results in damage and distortion of parts. In abrasive grinding in a barrel, with water, shot, and abrasive, it is the pressure of the shot mass which speeds up grinding and gives fine matte surface. If barrel runs too fast, impingement will result, with nicking of surface. Octagonal barrels are recommended over round ones, as they lift work and shot better. A gas vent to release pressure developed in tumbling is needed. An important difference in loading abrasive barrel work over burnished work is noted. Best size load for this work is about half full, as this provides longer flow of material down the inclined mass.

PHIL J. RITZENTHALER

CLEANING LEAD CASTINGS PRIOR TO PLATING

By Edward Finnie

(Reprinted from *Products Finishing*, August, 1941)

Lately, because of the shortage of zinc for domestic use, the zinc base die casting has been replaced by a 12 to 14 percent antimonial lead casting. And platers have had to change their cleaning cycle to meet the change in casting metal.

So that platers might have some information on the cleaning procedures in use by manufacturers at the present time, this paper will summarize the cycles that have been used successfully.

There are several methods in use and all of them use different cleaning solutions—by that is meant different proprietary cleaners. However, the cleaners have this in common–they are mild in nature, similar to cleaning solutions used for zinc base die castings. Rather than name brands of cleaners, the designation will be as mild cleaners and if the reader wishes to know which brand of cleaner is being used in a particular cycle, the writer will be only too glad to give it to him.

Cycle No. 1. Degrease. Clean cathodically in a mild cleaner at 160 deg. F. (change cleaner often). Rinse. Soak for 5 minutes in a 10 percent sodium cyanide solution at room temperature. Transfer directly to high speed copper for 5 minutes at 35 amps. per sq. ft. Rinse. Acid dip. Nickle plate.

Cycle No. 2. Degrease. Clean cathodically in a mild cleaner for 1 minute. Rinse. Dip in 5 percent by volume acetic acid. Rinse. Copper strike in a Rochelle salt copper bath at 2 volts or less for 10 minutes. Rinse. Acid dip. Copper or nickel plate.

Cycle No. 3. Wash in washing machine. Clean anodically in a mild cleaner for 5 to 20 seconds. Rinse. Dip in 3 percent sulfuric acid for 2 seconds. Rinse. Copper strike in a Rochelle salt bath at 10 amps./sq. ft. for 5 minutes. Rinse. Copper or nickel plate.

Cycle No. 4. Degrease. Clean in a mild cleaner cathodically. Rinse. Reverse current in a 55 deg. Baume sulfuric bath (a nickel strip solution will work) for 15-30 seconds. Rinse. Copper strike for 15-30 seconds at 5 volts.

Cycle No. 5. Clean cathodically. Rinse. Soak in hot water for 5 minutes. Transfer directly to nickel solution.

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DETINNING OF USED CANS

(From *Canadian Metals*)

In the 12 months of the calendar year 1939, approximately 70,000 long tons of tin were used in the United States; and, according to *Industrial Reference Service*, U. S. Department of Commerce, approximately 26,000 long tons of tin were used in containers. It is estimated that, if economical methods in collection of used tin cans were undertaken in the principal urban areas of the United States, about half the containers would be recovered and an estimated 12,000 long tons of tin could be made available for re-use.

Many methods for the recovery of tin from waste tin-plate have been devised, and a few are operated as successful private enterprises. While reaction with chlorine, and the production of tin tetrachloride from which tin may be recovered, is technically feasible, a more direct method was desirable and such a method has now been developed.

Essentially it consists of treating the scrap under controlled conditions of temperature and concentration of reagents in an alkaline bath to which is added a suitable oxidizing agent. This operation is conducted in open reaction vessels, and the tin is removed in the form of a water solution of sodium stannite. The liquor goes to a thickener, whence the caustic soda solution of sodium stannite, after removal of the lead, is pumped to a battery of electrolytic cells in which the tin is deposited on inert cathodes, usually of steel. From these cathodes the tin is removed by dipping directly into a bath of molten tin. In this manner a metal of good uniformity and high purity is recovered.

Obviously empty tinned containers cannot be transported long distances because of their bulk in relation to weight, and compression into bales would present to detinners an expensive operation to release the material in such form that all surfaces could be exposed quickly and thoroughly to detinning agents. Apparently, therefore, it is not feasible to collect tin cans from small communities or rural areas or from any place where there are no organized municipal or other agencies that collect the cans incidental to the collection of other domestic refuse.

In the United States, Government financing of new detinning plants has been advised against, unless and until an emergency in the supply of tin renders it imperative to conserve supplies without regard to cost.